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ABSTRACT

This final report concerns a pioneering, three-year curriculum development project dedicated to translating recent learning theory and laboratory findings into operational practice in an existing educational institution. This project produced a highly successful and unique course that teaches two semesters of economics that students can master in from six weeks to one semester's time. In the course, students negotiate individual learning contracts with instructors, making decisions on what they will study, what media they will use, and how fast they expect to progress. Detailed performance specifications were prepared first, and then media were selected and materials developed that would most effectively and efficiently meet those specifications. The report explains how the course was developed, including the rationales, methods, and procedures which were empirically tested. Only a few educational development projects comparable to this in scope and goals have been conducted. None appears to have been documented in the form of developmental model for use by others, as is done here. (Certain pages may not be reproducible due to marginal legibility.) (Author/DB)

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MODEL FOR DESIGNING A SYSTEM TO INDIVIDUALIZE INSTRUCTION AND GUARANTEE LEARNING:

A FINAL REPORT

Educational Technology Center
of Sterling Institute, Inc.
2600 Virginia Avenue, N.W.
Washington, D.C. 20037

August 1970

AA 000 626

FINAL REPORT

Contract No. N00600-68-750

MODEL FOR DESIGNING A SYSTEM TO INDIVIDUALIZE INSTRUCTION AND GUARANTEE LEARNING

Edmund W. Fitzpatrick
Educational Technology Center
of Sterling Institute, Inc.
2600 Virginia Avenue, N.W.
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August 1970

U.S. DEPARTMENT OF
HEALTH, EDUCATION, AND WELFARE

Office of Education
National Center for Educational Research and Development

PREFACE

The project reported here has major implications for many of our urgent educational problems. It deals with the process of how to "guarantee" learning. The process or curriculum development model, employed in the project evolved on the hard testing ground of operational reality--where many fine theoretical models have met with sharp defeat.

The model is radically different from the conventional approach of designing instruction, so it is understandable that the "course" it produced is radically different from other courses. Both the model and the course represent a bold attempt to make a greatly needed quantum jump in educational practice. The results of the project--supported by empirical data--are highly positive and very gratifying to those who dedicated their efforts to its success.

Educators who are familiar with projects of this type know the high risks of failure involved. And if indeed failure occurs, it takes place in the showcase of day to day school operations and involves many students, instructors, and administrative staff. Yet the risk is directly related to the potential gain, such as that which resulted from this project.

This project was initiated and funded by the U.S. Office of Education's Division of Comprehensive and Vocational Research (National Center for Educational Research and Development) out of a firm belief that such risks must be taken if there is to be progress. Risk taking, even for the best reasons, is not easy for any organization, particularly a federal agency involved in the sensitive field of education. Recognition should be given to Mr. Robert E. Pruitt, Director of the Division of Comprehensive and Vocational Research, and Dr. Richard B. Otte, the Project Officer for this project, for not only their courage but the quality of their personal involvement in the project from its start to its completion.

The project was conducted in cooperation with the U.S. Naval Academy, with Dr. Jesse Koontz the Project Officer for the Navy.

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J. Excerpt from TR-5.40, "Final Evaluation Report"

ABSTRACT

This final report concerns a pioneering, three-year curriculum development project dedicated to translating recent learning theory and laboratory findings into operational practice in an existing educational institution. This project produced a highly successful and unique course that teaches two semesters of economics that students can master in from six weeks to one semester's time. In the course, students negotiate individual learning contracts with instructors, making decisions on what they will study, what media they will use, and how fast they expect to progress. Detailed performance specifications were prepared first and then media were selected and materials developed that would most effectively and efficiently meet those specifications.

The report explains how the course was developed, including the rationales, methods, and procedures which were empirically tested. Only a few educational development projects comparable to this in scope and goals have been conducted. None appears to have been documented in the form of developmental model for use by others, as is done here.

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CHAPTER I

INTRODUCTION

In early 1967, the Educational Technology Center of Sterling Institute initiated in Washington, D.C., a major, pioneering Multi-Media Curriculum Development Project. The sponsors of the MMCD project were the U.S. Office of Education and the U.S. Navy. The purpose of the project was to produce the "best possible" educational course "by utilizing simultaneously each of several recent advances in the state of the art of educational technology."[1] The advances to be utilized were identified as the following:

- Systems and operations analysis in planning
- Identifying and stating educational and training objectives
- Rationales for media employment
- Research in techniques for the programming and utilization of materials in the several media
- Empirical process of materials revision[2]

The solicitation material expressed the fact that primarily these advances were (a) of a theoretical nature or (b) based on experiments that have yet to be applied in operating environments. The problem, from the standpoint of project activities, was to translate this research into technology--i.e., to apply these advances in a real-life, operational setting under the constraints of time, money, manpower, and the limits of knowledge, to produce the "best possible" course.

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[1] U.S. Navy Purchasing Office, solicitation material for procurement N00600-68-B-0022, Step 1, July 20, 1967.

[2] *Ibid.*

The Educational Technology Center (ETC) proposed a conceptual model and a detailed technical approach that sought to reflect the latest advances in educational technology and educational research.[3] The technical approach took the form of a detailed plan that described how the new theoretical and experimental advances would be applied in the project.

The course that resulted from this project has proved to be very successful. The course is both validated and replicable. The course, which is currently in operation, has been described by the Educational Technology Center with the following paragraphs:

> A highly individualized, "multi-media" introductory economics course that virtually guarantees learning has been developed by the Educational Technology Center of Sterling Institute. This course, developed under the joint sponsorship of the U.S. Office of Education and the U.S. Navy, has been operationally tested at the U.S. Naval Academy in Annapolis, Maryland, since January, 1969. While senior economists state that the course teaches two semesters of economics, some students complete the course in one third of a semester,

---

[3] Educational Technology Center, Development of a Multi-Media Course in Economics for the United States Naval Academy: Technical Proposal 1 (Washington, D.C.: Sterling Institute, 1967). (Hereinafter referred to as Technical Proposal 1.)

and all students can complete it in a single semester. A variety of media are employed, including self-instructional audio packages, self-instructional printed packages, computer-based simulation models on commercial time-sharing systems, and 16 mm. film.

In the course, students negotiate learning contracts with instructors, making decisions on what they will study, what media they will use, how fast they expect to progress, and so forth. The student can largely determine what enrichment activities, if any, he will take part in or conduct, including any he wishes to originate himself. Essentially, all that is required for a student to "pass" the course is that he be able to pass a series of comprehensive criterion-referenced tests relating to core requirements.

The course consists of four major concept areas, Basic Economics, Macro Economics, Micro Economics, and Domestic and International Issues. These concept areas consist of thirty-five topics organized into over 100 core and enrichment "segments." Each segment, averaging about thirty to fifty minutes of student learning time, is designed to produce specific, measurable learning.

Criterion-referenced pretests and post tests are used for course units and concept areas. Practice problems and illustrations are embedded in the learning. Self-tests are strategically located so students can evaluate their own progress. In responding to practice problems and other test items, the student uses a small, portable response device called a QRS (Quick Response System). A light comes on only when a student presses they key for the correct answer. At the same time, the QRS maintains a record of both incorrect and correct responses, in the form of a computer-processable punched card.[4]

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[4] Paragraphs provided by the Educational Technology Center, Washington, D.C., January 5, 1970.

In the semester ending in January of 1970, ninety-eight percent of the students achieved eighty percent or more of the core objectives of the course, and some ninety percent of the students achieved a substantial number of enrichment objectives (i.e., earned sufficient enrichment points to raise their grade level to a "B" or more).[5] Appendix A provides a description of the components of the course, while Appendix B provides comments on media applications in the course.

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[5] The Academy gave a grade of "C" if a student achieved all of the core objectives and a "B" or an "A" depending on how many enrichment objectives he also achieved. The overwhelming majority of students earned B's and A's.

CHAPTER II

PROJECT PLANNING

Perhaps the fundamental reason for the success of the Multi-Media Curriculum Development Project was the philosophy underlying its preliminary planning and subsequent management. This philosophy may be referred to as the "systems approach." It included the view that a primary function of project planning and management was to optimize among alternatives in most effectively and economically achieving the specified goals. Thus, the identification of alternatives and allocation of resources in a way judged to be optimal were activities growing out of this philosophy.

Since the systems approach was the guiding philosophy in planning and managing the project, it is important that the view of this approach, as held by the project management, be described before specific project planning and management activities are dealt with.

The Systems Approach

The systems approach may be defined as the application of scientific methods and tools to the prediction and comparison of the values, effectiveness, and costs of a set of alternative courses of action involving man-machine systems.[1] The systems approach seeks to take into account the interrelationships of all significant elements of a problem and of its solution--hence the term "system."

A system must be goal-directed. In education, the goal is learning. It is important to be able to know if a system is achieving its goals. More specifically, it should be possible to measure (a) when and how well a specific goal is being met by the system and (b) which system elements are contributing in an acceptable way toward meeting that goal. This calls for precision in designing a new system or identifying the significant elements in an existing system. In addition, it also calls for a "feedback loop," i.e., a means for measuring effectiveness, for evaluating the results, and for modifying or revising the system, as necessary, to better meet the goal.

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[1] Donald W. Meals, "Heuristic Models for Systems Planning," Phi Delta Kappan, January, 1967.

Note that the term "systems," as used in "systems approach," is plural. This underlines a key concept of the systems approach, namely that every system is a subsystem of a larger system. Our concern may be with a University's School of Education as an instructional system, or we may be concerned with a specific course taught by a specific instructor in one department of that school. In any case, it is important to recognize, for planning and management, that each of these instructional systems is a subsystem of a larger system, and therefore must be responsive to the needs (or "constraints") of that larger system. An illustration of this relationship is given in Figure 1.

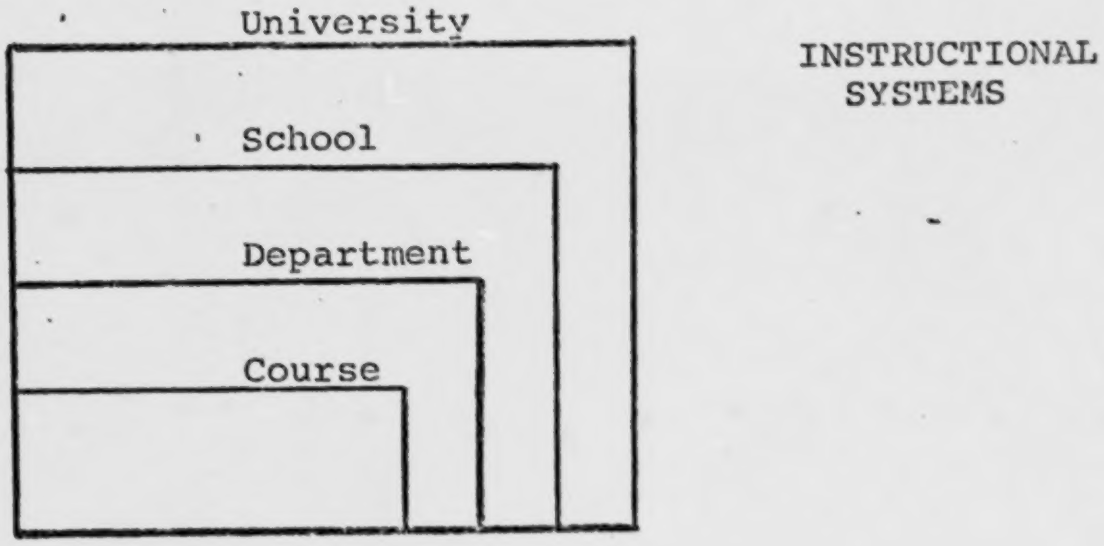

Fig. 1.--Instructional Systems as Subsystems

The concept illustrated in Figure 1 is intended to aid the planner-manager to broaden the scope of variables he must consider as possibly relevant to a problem or its solution. The objective is to guard against overlooking key variables, which Goodlad, for example, believes to be a primary cause of the practical ineffectiveness of much of the curriculum research being reported today.[2] It must be clearly understood that each "system" operates within an "environment" that is at least partially created by the larger system of which it is a part.

Let us consider the position of the instructor at a university. An instructor cannot develop a course and present it at a university with complete disregard for his fellow faculty members, the department, the school, and other factors. While he may have much freedom in creating his course, he must take into account the constraints imposed by the "larger system." If he fails to do this, his course may "fail."[3]

There is a relationship between the goals stated and the system needed to accomplish the goals. In a university, the goals of each school should be a subset of the university goals. Similarly, the goals of a department should be a subset of the goals of the school. The point is that the goals selected for the larger system have an impact on what are acceptable goals for the smaller systems (i.e., subsystems) of which it is composed. In designing an instructional system, one of the first activities is to ascertain the general goals of the larger system (e.g., the economics department) to help ensure that goals specified for a smaller system (e.g., a course within the department) will be compatible. Having specified "compatible" goals, a system can be designed with a higher probability of meeting them.[4]

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[2] John I. Goodlad, "Curriculum: State of the Field," Review of Educational Research, XXXIX, No. 3 (Washington, D.C.: American Educational Research Association, 1969), 367-375.

[3] Indeed, it may be argued that the major reason for the failure of innovation after innovation in our school systems has been because some of the most relevant variables are being overlooked.

In the systems approach, system elements--people, materials, equipment, procedures, strategies, etc.--must be justified or justifiable, in a measurable way, in terms of their contributions, quantitatively and qualitatively, to achieving the specified goals. The feedback-evaluation-revision process is intended to determine how well a particular component is performing. If the performance is below the minimum acceptable level, the element must be modified or eliminated (perhaps to be replaced with some alternative).

---

[4] It is not at all unusual for an organization to have goals that are entirely unrealistic in terms of the system which exists. For example, the system needed to "eradicate crime" in a city may have little relationship to the existing system.

Applying this to the design of an instruction system would mean that if the student-learning goals were not achieved the system elements would be evaluated and modified or replaced as necessary to improve overall system performance. It would mean that all components of the system--including teachers and administrators--would be held accountable for performing certain functions in an acceptable way.

Preliminary Planning

The systems approach, as described above, provided the framework for planning and conducting the Multi-Media Curriculum Development Project. Within this framework, a conceptual model of the end-product of the project was prepared and a detailed plan for producing that product was laid out.

Conceptual Model

It was concluded, after reviewing the solicitation material provided by the government, that it would be appropriate to develop a multi-media/methods course which reflected the model shown in Figure 2.[5] It was stated in the proposal that a course produced in conformance with this model would have the following characteristics:

- Course content would support specific behavioral objectives.
- Types and conditions of learning judged most efficient in inducing the specified behaviors would largely determine the media and methods to be employed.
- Measures of attainment of behavioral objectives would be quantitative, and while testing situations might vary, all test results would be maintained in computer storage.
- The computer would use test results in conjunction with other data to generate prescriptions of learning packages for students.
- Each learning package would be empirically validated.
- Characteristics of the individual sample of behavioral objectives would provide the basis of each student's learning package.
- At the end of a particular package, the student would receive almost emmediate knowledge of results, work at his own pace, and have a high degree of success in the learning situation.
- Much of the instructional material would be of a self-instructional nature.[6]

---

[5] Model for a Single Course Instructional System from "Designing an Organic Curriculum," paper prepared by R.M. Morgan and D.S. Bushnell (Bureau of Research, U.S. Office of Education, Washington, D.C., 1966).

[6] Educational Technology Center, Development of a Multi-Media Course in Economics for the United States Naval Academy: Technical Proposal 1 (Washington, D.C.: Sterling Institute, 1967), p. III.1.

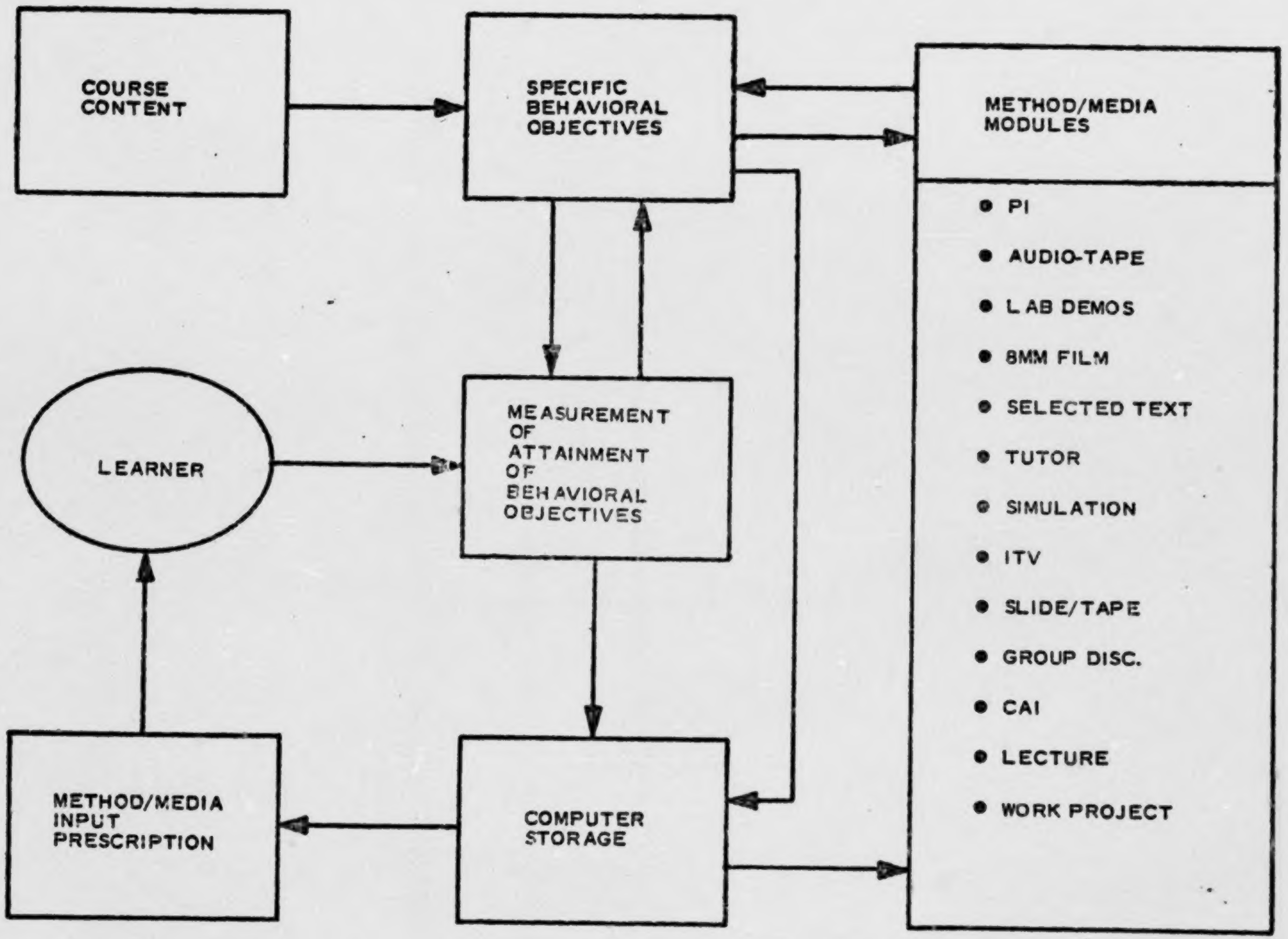
COURSE CONTENT
SPECIFIC BEHAVIORAL OBJECTIVES
METHOD/MEDIA MODULES
PI
AUDIO-TAPE
LAB DEMOS
8MM FILM
SELECTED TEXT
TUTOR
SIMULATION
ITV
SLIDE/TAPE
GROUP DISC.
CAI
LECTURE
WORK PROJECT
LEARNER
MEASUREMENT OF ATTAINMENT OF BEHAVIORAL OBJECTIVES
METHOD/MEDIA INPUT PRESCRIPTION
COMPUTER STORAGE

Fig. 2 .--Model for a Single Instructional System

Source: Model for a Single Course Instructional System from "Designing an Organic Curriculum," paper prepared by R.M. Morgan and D.S. Bushnell (Bureau of Research, U.S. Office of Education, Washington, D.C., 1966).

Program Plan

The preliminary planning activities produced a complete "program plan" for producing a course resembling the model. This plan included task descriptions, staffing estimates, budgets, schedules, and other comparable items bearing on time, money, manpower, and techniques. A total of fourteen tasks were defined, to be accomplished in three phases over three years. The names of the tasks planned were:

1. Prepare Course Descriptions
2. Define Core Behavioral Objectives
3. Sequence Core Behavioral Objectives
4. Specify Additional Behavioral Objectives
5. Prepare Test Items
6. Prepare Criterion Referenced Tests
7. Prepare Norm Referenced Tests
8. Select Media
9. Prepare Materials
10. Develop Evaluation Plan
11. Write and Debug Computer Programs
12. Course Validation and Design Document Revision
13. Revise Materials
14. Prepare Final Report

CHAPTER III

PREPARE COURSE DESCRIPTION

The first formal task, based on the program plan, was to "Prepare a Course Description." The scope of this task was much larger than its title implies, since it was directed toward defining the general goals of the new course, the environment within which the new course would be presented, the characteristics of the target population, and other major variables and constraints that applied to the development of the course.

Define Target Population

A primary consideration in designing any instructional program is who the program is for and what these students will be like when they start the program. The characteristics of the target population have implications for virtually all aspects of the program design and, for this reason, it is important to "define" the target population at an early stage in the design activities.

The specific characteristics of the target group, including the degree of homogeneity or heterogeneity, provide information needed to most effectively make decisions in such areas as the following:

1. Knowledges and skills to exclude because the target group possesses them
2. Entry competencies to plan for in knowledge-skill areas pertinent to the program
3. Probable areas for prerequisite deficiencies
4. Attitudes to contend with, positive and negative, including level of achievement motivation
5. Probable differences in learning rates or amounts of learning per unit of time
6. Appropriateness of different instructional strategies, including media applications

The importance of such information for decision-making was fully understood in the MMCD Project. Accordingly, formal steps were taken to obtain all "readily available" information regarding the target population for the new multi-media economic analysis course at the Naval Academy.

The types of information sought may be summarized as follows:[1]

1. Size and location
    - a) Size of target population and rate of increase or decrease
    - b) Location of the group
    - c) The instructional "unit" size (e.g., 1,000 freshmen college students, thirty students per class and six classes), if one currently exists

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[1] It should be emphasized that this refers to information sought. This does not mean each item of desired information was obtained. Only "readily available" data were obtained, and these were very limited.

2. Achievement

    a) Scores (mean, range, and standard deviation) on standardized, national achievement tests

    b) Scores (mean, range, and standard deviation) on validated local achievement tests, and on any tests that will provide information about achievement levels in those areas that the course will deal with.

3. Interests, aptitudes, and personality

    a) Expressed interests of the group

    b) Group interests as measured on valid tests

    c) Aptitudes as measured on valid tests.

    d) Valid data about personality characteristics of group members

        (1) Rate of learning
        (2) Style of learning
        (3) Autonomy needs
        (4) Affiliation needs
        (5) Achievement motivation
        (6) Anxiety level
        (7) Cautiousness
        (8) Original thinking
        (9) Personal relations

4. Socio-economic information

Resources and Constraints

Much of the effort relating to the preparation of the Course Description document involved identifying possibly relevant resources and constraints, as was originally planned. It is of much benefit to all subsequent planning if key resources and constraints can be identified early in the project, as was the case in the MMCD Project.

Constraints are the limitations imposed on a project from any source. The most common constraints in the project were limitations of:

- time
- money
- personnel
- knowledge

These constraints were of constant concern in the preliminary planning and subsequent course management; they were identified and reflected in the original program planning and were continuously monitored in subsequent project activities.

There were a number of other constraints, however, that played an important part in project activities. The target population represented a major constraint. The developed course had to be tailored to the entry characteristics of the students. Further, the course had to present a process which enabled the student to successfully complete the course within a time limit. And the students and instructors had to subjectively find the course "acceptable."

Another type of constraint that was of key importance was the policies of the Academy and the specific department for which the course was being developed. Existing policy had to either be observed or changed. If it was ignored, there was the risk of finding out too late that it should have been observed. In order for a developmental project to be successful, the support of the top decision-makers is usually essential. When policy is obviously outdated, it is probably better to influence a change at the top rather than to risk ignoring it at the operation level.

Other constraints taken into account included the relationship of the proposed course to other courses, the amount of study time the target students may have, the operating structure and procedures of the organization within which the course was to operate, the number and characteristics of the teachers, and so on. (The kinds of constraints that will apply and their relative significance will, of course, vary from project to project.) It was thought to be very important to have a clear idea of what actually constituted a constraint and what did not (i.e., was something that could be changed).

Macro-Planning Chart

A major development was the emergence of the Macro-Planning Chart. During the early weeks of the project, it became apparent that some form of visual planning tool was needed so that various parts of the course could be viewed in perspective. It was believed that such a tool would also serve as an aid in analyzing time-topic relationships and media-usage logistics. Since, in general, (a) the fifty-minute class-hour was familiar to instructors and (b) few single learning events could be expected to exceed fifty minutes in the developed course, it was decided to construct a chart that divided all of the student time available for the course into fifty-minute "segments." This chart was given the name "Macro-Planning Chart." The construction of the Macro-Planning Chart is further explained in the paragraphs below.

Under the contract, a student was to spend six fifty-minute hours a week studying "core" material and three fifty-minute hours a week studying "enrichment" material or "remedial" material, or some combination of both. Since there were seventeen weeks in the semester, the total number of "core" hours required for the new course was 102 (i.e., six hours per week times seventeen weeks). Similarly, it was expected that fifty-one "remedial" hours and fifty-one "enrichment" hours (i.e., three hours per week times seventeen weeks, for each) would be provided. Each such fifty-minute hour was termed a "segment." In the course, therefore, there were to be 102 core segments, fifty-one enrichment segments, and fifty-one remedial segments.

This segmentation plan was applied to each of the major concept areas (groups of instructional topics particularly related in some way). Figure 3 shows the Macro-Planning Chart that was produced for Concept Area I of the course. Note that there were four enrichment segments provided, twelve core segments, and five remedial segments.

The Macro-Planning Chart prepared for a concept area indicated the number of fifty-minute student hours, or segments, that could be devoted to enrichment, core, and remedial instruction. The segments were looked upon as "time buckets" which were to hold instructional activities, primarily in the form of instructional topics. The names of specific instructional topics were assigned to specific course segments. In Concept Area I, for example, the topic "Specialization" was assigned segments numbered C6 and C7. A minimum of twenty percent of all segments were reserved for testing and counselling, with the percentage varying for given concept areas.

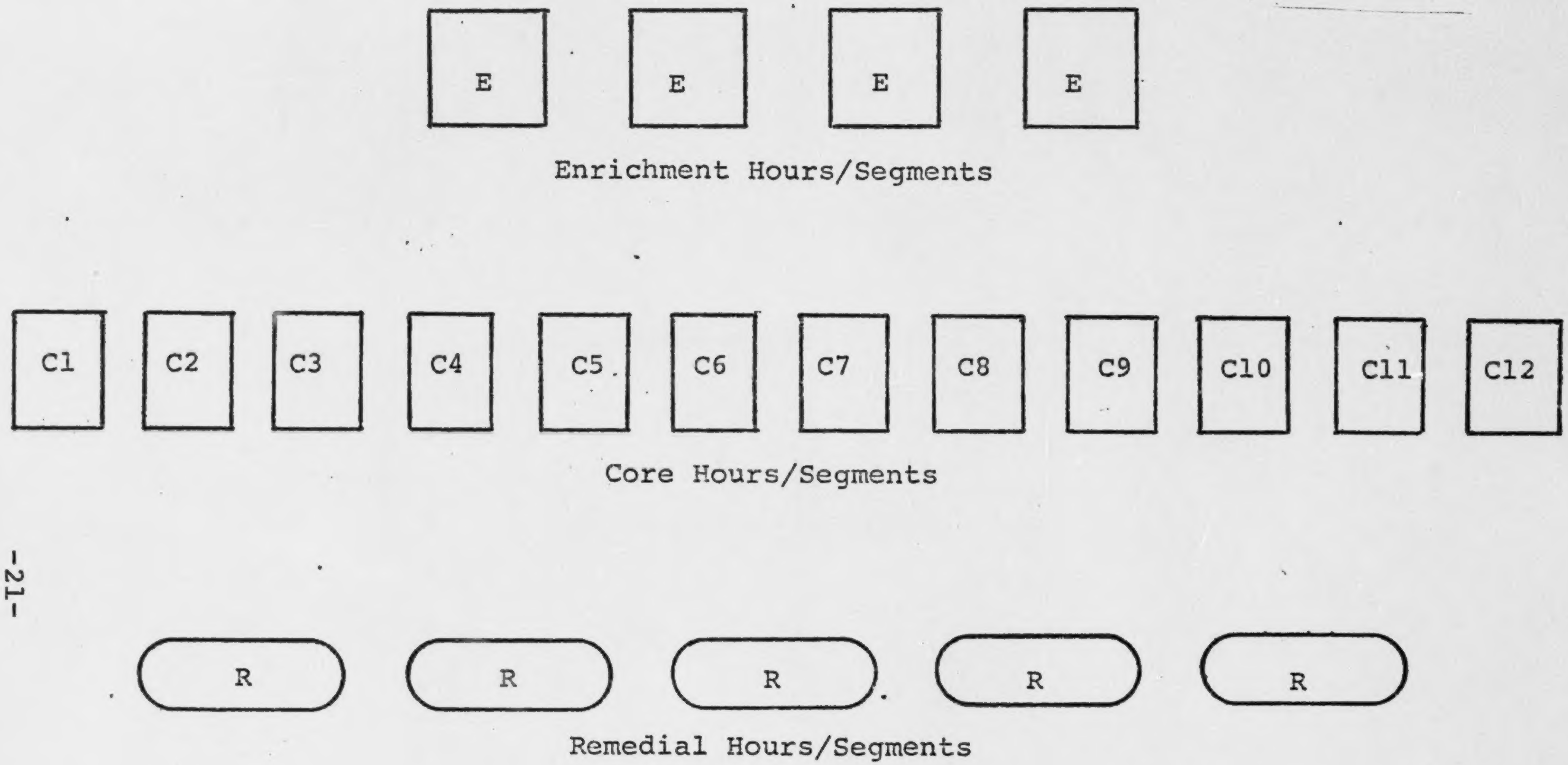
E
E
E
E
Enrichment Hours/Segments
C1
C2
C3
C4
C5
C6
C7
C8
C9
C10
C11
C12
Core Hours/Segments
R
R
R
R
R
Remedial Hours/Segments

Fig. 3.--Macro Planning Chart for Concept Area I

The Macro-Planning Chart provided a rough "time limit" for specific instructional topics. If one topic were assigned two segments, this would mean that a total of 100 (fifty plus fifty) instruction/learning minutes were available for that topic. If two instructional topics were assigned to the same segment, it meant that fifty minutes of instruction/learning time had to be divided between the two topics. The effect was to cause decision-making based on trade-off analyses. Questions were raised about the relative importance of different topics and what was important and not important within a given topic.

The Macro-Planning Chart proved to be highly useful in connection with determining the detailed sequencing of events included in the course. It became the "drafting board" of the detailed instructional sequencing (sequencing is discussed in a later section of this report).

CHAPTER IV

DEFINE BEHAVIORAL OBJECTIVES

Perhaps the most critical task in the design of an instructional system is to determine the behavioral objectives. During the first phase of the MMCD Project, by far the greatest amount of effort was devoted to establishing and gaining agreement on the behavioral objectives. Indeed, of any problems encountered during the MMCD Project, those associated with the performance of this task were unquestionably the most difficult to resolve.

As Gagné has pointed out, nearly every writer who has attempted to describe the factors to be taken into account in designing instructional programs has paid attention to defining objectives.[1] Gagné, in his The Conditions of Learning, lists "learning objectives" as having the first priority in educational decisions.[2] In the project, a major problem was encountered in trying to gain agreement on behavioral objectives. Since this problem has been widespread, the general background to the problem is stated before the attempts to resolve it are discussed.

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[1] Robert M. Gagné, "The Analysis of Instructional Objectives for the Design of Instruction," Teaching Machines and Programed Learning, II: Data and Directions, ed. by Robert Glaser (Washington, D.C.: DAVI, NEA, 1965), pp. 21-65.

[2] Robert M. Gagné, The Conditions of Learning (New York: Holt, Rinehart and Winston, Inc., 1965), p. 263.

Background

Robert F. Mager's Preparing Objectives for Programmed Instruction is perhaps the most widely used reference by persons seeking to define behavioral objectives for their education or training programs.[3] This text, however, applies only when the objectives have been established, since it describes only how to state the objectives. Some who have used this text have confused the process of stating objectives with the process of deciding what objectives to state. The literature is rich with material on how to state objectives. The situation is quite different regarding how to establish and gain agreement on objectives, a process which must precede stating the objectives.

One of the key factors contributing to an apparent emphasis on stating objectives versus establishing objectives would seem to be the setting in which instructional objectives were first employed on a meaningful scale. This environment was military training research, particularly on the training of electronic technicians. One of the first things done in planning such training was to "identify" the objectives. The objectives were identified by analyzing the task for which the person or persons were to be trained. This "task analysis" produced, in turn, a "task description" which stated what a person does to satisfactorily perform the task. Behavioral objectives were "identified" from the performances specified in such task descriptions.

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[3] R.F. Mager, Preparing Objectives for Programmed Instruction (San Francisco: Fearon Publishers, 1962).

This process of establishing the instructional objectives was appropriate in such military training situations, and the process works well where training for specific jobs is concerned. It was not until attempts were made to transfer this process to "education" that severe difficulties were encountered. While training is often thought of as directed toward a specific job, education tends to be viewed as a process which prepares a person to live in a desired society of the future.[4] It is much easier to gain agreement on what an "electronics technician" must be able to do than what a "good citizen" must be able to do.

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[4] For a discussion of the philosophical basis of education and the implications for education, see Melvin M. Tumin's article, "Education and Educators in a Changing Society (Part One)" in Preparing Educators to Meet Emerging Needs, ed. by Edgar L. Morphet and David L. Jesser (New York: Citations Press, Scholastic Magazine, Inc., 1969).

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In the occupational training situation, the scope of variables to be considered may be relatively narrow, and philosophical variables may not enter into consideration. The task description, in any case, can serve as the controlling document in that situation.

In education, it is very difficult to even gain agreement on what the task is, let alone its description. While people can agree on broad generalities of what a "desired future" should be, it has been a major problem to obtain agreement on the specific operational implications of such a future for the present educational process. The method for "preparing instructional objectives," as developed from the research on military training, does not provide the mechanism for establishing "educational" behavioral objectives. Moreover, an examination of the general body of literature in the field of education fails to reveal that a satisfactory mechanism has been developed for gaining interpersonal or inter-group agreement on specific behavioral objectives for "educational" curricula.[5]

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[5] The terms "interpersonal" and "inter-group" refer to persons in different disciplines or at different schools, who have an opportunity to freely reject or to accept and use a given set of behavioral objectives.

The need for establishing measurable objectives for education has been argued for nearly fifty years, the Winnetka Plan during the 1920's being one of the earliest attempts at producing such objectives as part of a complete program.[6] Ralph W. Tyler's work at the University of Chicago in the 1940's provided an important impetus for developing techniques for establishing educational behavioral objectives.[7] A notable outcome of this impetus was Benjamin Bloom's "taxonomy" published in 1956, which was one of the first attempts to produce a comprehensive list of educational objectives for general use.[8] This and the subsequent taxonomies of educational objectives represent a major step in translating abstract goals of education to more specific meaning.

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[6] See, for example, C. Washborne, Mabel Vogel, and W.S. Gray, "A Survey of Winnetka Public Schools," Journal of Educational Research Supplementary Educational Monograph (1926).

[7] See R.W. Tyler, Basic Principles of Curriculum and Instruction: Syllabus for Education 305 (Chicago: University of Chicago Press, 1950); and R.W. Tyler, "The Functions of Measurement in Improving Instruction," Educational Measurement, ed. by E.F. Lindquist (Washington, D.C.: American Council on Education, 1950).

[8] B.S. Bloom, ed., Taxonomy of Educational Objectives (New York: Longmans, Green, 1956).

While Bloom's taxonomy proves to be a useful guide to different classes of objectives, it does not provide operational-level objectives. Moreover, the objectives it lists have been criticized for being ambiguous and, in general, not meeting the criteria for "good" behavioral objectives as described by Mager and others.[9] Nor does the taxonomy face the issue of how to gain agreement on specific behavioral objectives.

Edling's review in 1968 of the research concerning educational objectives suggests that few, if any, researchers are investigating the question of how to gain interpersonal or inter-group agreement on sets of behavioral objectives.[10] The literature continues to imply that the basic problem is how to state behavioral objectives, rather than how to establish them and gain agreement on them.

It is, nevertheless, an open secret among educational researchers that there have been a series of failures in attempts to specify educational behavioral objectives that are acceptable to the group of educators who would be expected to employ the objectives. In general, the failures are fewer in the hard sciences where the "task" can be agreed upon (e.g., arithmetic, physics), but are the rule in the social sciences and humanities (particularly when the instruction is aimed at high school or college students), where each instructor might visualize the "task" in a different way. Human beings, of course, are not prone to publish information about their unsuccessful activities.

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[9] See, for example, Gagné's "The Analysis of Instructional Objectives for the Design of Instruction," p. 40.

[10] Jack V. Edling, "Educational Objectives and Educational Media," Review of Educational Research, XXXVIII, No. 2 (1968).

Maguire published the results of an experiment that concerned a critical issue in designing curricula in the humanities and social sciences--the differences in value judgments by teachers as regards specific, randomly selected educational objectives.[11] While his study is a contribution, it was, nevertheless, a paper and pencil "laboratory" experiment. Nobody really had anything to lose, unlike the actual curriculum design situations where a person may believe his professional reputation is at stake.

Project Activities

The first phase of the Multi-Media Curriculum Development Project concerned preparing a definition, or set of specifications, for the desired course. A major part of these specifications consisted of educational behavioral objectives. In the second phase of the project, material was prepared to meet the specifications. The materials also were subjected to tryout-revision cycles until they produced the learning called for by the behavioral objectives. Phase Three required fully-operational tryouts and a formal evaluation of the highly individualized new course. In this course, the students have a voice in what behavioral objectives they will pursue, and some students complete two semesters of economics in one-third of a semester.

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[11] Thomas O. Maguire, "Value Components of Teachers' Judgments of Educational Objectives," AV Communication Review, XVI, No. 1 (Spring, 1968).

Economics instructors from a number of universities took part in producing the behavioral specifications for the course. All told, about twenty economists had a voice in the course design. They represented a wide range of different theoretical views and practical experience in economics, with both the Friedman school and the Keynesian school represented. There were differences in personalities, politics, approach to life, and view of what is "good" economics. It was reasonable to expect great differences in value judgments on individual educational objectives.

Under the contract, the new course was to teach to the same objectives as the comparable, existing course at the U. S. Naval Academy, though new points of emphasis could be provided. Theoretically, then, the behavioral objectives could be established, at least in part, through information about the existing economics course. It was soon found that no two instructors were in fact teaching the same introductory economics course.

The process of establishing behavioral objectives began with gaining agreement on limits of student study time, the instructional topics to be included in the course and the average amount of student learning time to be devoted to each topic, as reflected in the Macro Planning Chart. This proceeded without difficulty. The next step was to establish the specific behavioral objectives of the topics; that is, to specify the terminal behavioral objectives, intermediate behavioral objectives, and entry behavior requirements for each topic. Problems were encountered almost immediately as this step got underway.

Nature of the Problem

A major problem was the difficulty encountered by some individuals of thinking in terms of what the student would be expected to do. In such cases, the way of thinking tended to concern instructor objectives, media objectives, and content coverage. Such thinking proved to be very resistant to change, despite attempts by behavioral specialists to reorient such thinking to "learner" objectives.

A second problem was the belief that students learn what the instructor covers. The conventionally-taught course at the Naval Academy "covers" two semesters of economics in one semester. The belief was held that the students do learn the material presented conventionally, though there are individual differences in the quality of the learning. Since educational technology should enable the students to learn faster and better, it was believed by the faculty that behavioral objectives should be prepared for all of the material now covered conventionally.

A third problem concerned how to delineate a course that would satisfy all of the economics faculty teaching the course. Each instructor seeks to teach the best economics course he can. This results in differences in the emphasis given to various points, differences in actual subject matter covered, and differences in the sequencing of the instruction. The developed course, it was found, must include the normal substance plus the instructors' variations in subject coverage and points of emphasis, if it is to be considered fully acceptable in terms of content coverage to each instructor. Such an approach, it is clear, would produce a "super-size" course.

A fourth problem concerned the human desire to take advantage of the course development opportunity by creating the highest quality course possible, with each part of the course being "powerful" in its own right. While this may or may not contribute to an effective course, it alone can increase the size of the course over any comparable conventional course because it seeks to achieve the "ideal" course, as seen by the faculty--i.e., all of the content the faculty would like to teach but do not have sufficient time to include in the courses they were then teaching.

The effect of these various problems was to cause packages of behavioral objectives to be repeatedly viewed by Academy faculty as incomplete, and therefore unacceptable, in terms of the desired content coverage. Course size grew as "content gaps" were filled by preparing additional behavioral objectives to meet the particular demands of individual instructors.

This was the nature of the overall problem of establishing behavioral objectives as encountered very early in the first phase of the project. As soon as the problem became apparent, a series of attempts were made to resolve it. Finally, a technique evolved which, in fact, did resolve the problem.

Attempts at Resolution

Several approaches to establishing behavioral objectives were tried which proved to be unsuccessful in this project. However, each unsuccessful approach provided new information which finally led to producing a successful approach. Accordingly, the unsuccessful attempts, as well as the successful one, are described below.

Approach #1

The start of the first phase of the project was delayed by the government some six months, causing original arrangements for subject matter experts (i.e., economics instructors) to be lost. (Since all subject matter experts were economics instructors, they will be referred to simply as "economists" in the subsequent material.) As a result, the project was begun with fewer economists on the ETC staff than had been planned. Given this situation, it was decided to use a larger percentage of the non-economist staff members in helping to generate behavioral objectives. These staff specialists were trained behavioral analysts, could write feasible, measurable, and observable objectives, and had individually begun the study of economics as part of their preliminary project activities. Similarly, all economists were asked to follow an ETC-prescribed program to orient themselves toward educational technology and writing behavioral objectives.

The Educational Technology Center's economists and the economics faculty readily agreed on topics and general goals for the topics. Much time was spent discussing how material in a topic was to be "handled." The ETC economists then conveyed a description of the goals for a given topic to a behavioral analyst, also referring him to material in standard economics texts and other sources that would be relevant. The behavioral analyst was to analyze the relevant material in terms of the stated goals and then to prepare behavioral objectives that represented a feasible translation of the goals. Each analyst was expected to interact frequently with the ETC economist responsible for his assigned topic, as a means of ensuring that goals were being translated to acceptable behaviors.

This approach did not work, despite many revisions of it. Economists, whether with ETC or the economics faculty, found difficulty agreeing among themselves on which specific behavioral objectives, from among those prepared, should be considered "acceptable." On the other hand, the economists did agree that the problem resulted from non-economists attempting to prepare the behavioral objectives. The behavioral analysts, though, stated that the economists could not commumicate to them the behaviors they wanted, but made general references to content and how it should be treated.

As a means of attacking the problem, steps were taken to (a) increase the quality of communication among the economists and between the analysts and the economists and (b) provide more intensive training of economists in the meaning and preparation of behavioral objectives. To increase the quality of communication, (1) extensive meetings were held before, during, and after behavioral objectives were prepared for a particular topic, (2) detailed writeups were prepared by the economists for each topic (each writeup was supposed to contain the terminal behavioral objectives for the topic), and (3) lengthy audio-taped oral statements between parties regarding "agreed-upon" content requirements and terminal behaviors were made.

None of these, however, was effective. It seemed that the economists could not write behavioral objectives acceptable to the behavioral specialists, and the behavioral specialists could not write behavioral objectives acceptable to the economists. In general, the analysts continued to talk "measurable behaviors," while the economists continued to talk "content." While there was much talk between them, there was little communication.

The economists believed that the way to resolve the problem was for them to tutor the analysts in economics so that the analysts could understand what the economists were trying to tell them. The analysts, on the other hand, were convinced that the economists still had not accepted the notion of behavioral objectives and that, until they did, there could be no real progress. The analysts stressed that, at minimum, the economists must prepare the specific, terminal performance (behavioral) objectives for each topic.

Much effort was spent attempting to teach economists how to write "good" behavioral objectives. In general, the more teaching experience an economist had, the more difficulty he appeared to have in accepting or writing behavioral objectives (but there were some very notable exceptions to this). This created an awkward situation in which the junior economists, in the view of behavioral specialists, acquired an understanding of behavioral objectives--indeed, were able to write "good" objectives--long before the senior economists did.

The initial reaction of the senior economists toward behavioral objectives was largely unfavorable, and this attitude seemed to persist throughout approach #1. During this period of several weeks, no senior economist was able to write objectives that, according to the behavioral specialists, were unambiguous, measurable, observable, and feasible. (Some senior economists later became very proficient in this.) In any case, from reviewing the work of the behavioral specialists, the economists reached the conclusion that behavioral objectives prepared by non-economists could never be satisfactory. The primary reasons given by the economists were that the analysts often missed the point, often emphasized the wrong things, and continuously left important things out (i.e., there were gaps in content coverage).

Approach #2

As the number of economists on the project team grew, it became possible to initiate a new approach which, it was hoped, would produce behavioral objectives which the senior economists--particularly the faculty that taught the course--would find acceptable. Approach #2 called for creating work teams consisting of one junior economist and one behavioral analyst, who would work under the cognizance of a senior economist. It was reasoned that the junior economist could help insure acceptance from the senior economists while the analyst would make sure that the behavioral objectives were properly written.

The same problems that were found in approach #1 quickly emerged in approach #2. There seemed to be the same inability to prepare "acceptable" behavioral objectives. In desperation, senior economists were preparing larger and larger descriptions of topics for use of the two-man teams, but the senior economists still found themselves unable to provide the terminal behavioral objectives that met the standards of the behavioral analysts. Meanwhile, the junior economists who were paired with analysts learned to write fairly good behavioral objectives, in the judgment of the behavior specialists.

This approach also did not work. Attempts to "orient" the senior economists to behavioral objectives continued almost constantly, but with no apparent success. The failure of this approach led to approach #3.

Approach #3

This approach called for a senior behavioral scientist to be paired with a senior economist. Together, they would write the behavioral objectives for a topic, and both participants had to agree on the specific objectives before they could complete a topic. The behavioral scientist's role was to guide the economist into producing or accepting the behavioral objectives that defined the senior economist's interpretation of the topic's goals and scope of content. While the output of approach #3 was judged by the economists to be the best thus far, it proved to be extremely taxing on the participants and therefore could not be continued. While this approach was being discontinued, approach #4 became possible.

Approach #4

In this approach, narrative descriptions of topics were virtually discarded. Instead, reliance was placed on preparing behavioral "hierarchy charts" that defined topics. The concept of a hierarchy chart as used in approach #4 evolved out of the failure of narrative information, both written and oral, to communicate among team members. At first, the hierarchy charts were strictly the province of the behavioral analysts who used them in attempting to define the structure of a topic. More specifically, after an economist described a topic, the behavioral analyst would then attempt to translate this information into behavioral objectives, and he would arrange these objectives in a hierarchical fashion to indicate presumed relationships of the indicated competencies, including the dependency relationships, prerequisite competencies, etc.

Senior economists, whether with ETC or the economics faculty, had declined hierarchy charts because they did not convey, in their view, the full range of content required. Gradually, however, the charts became the working document of communication between senior economists and the analysts and between junior and senior economists. Soon the charts began to include the more detailed descriptions of content required by the economists. At the same time, the behavior or behaviors that would demonstrate if a person has that knowledge were, as before, stated in the charts. As a result, economists and analysts were both satisfied, because the charts communicated equally well with both groups. Since each box on a hierarchy chart included (a) description of content and (b) one or more behavioral statements, the charts could readily communicate with people of widely different backgrounds, including administrators, instructors, psychologists, and students.

Prior to the use of approach #4, if an economist did not like the behavioral objectives for a topic, the analyst generally was blamed. As a result, the economists found that they agreed in not liking behavioral objectives produced by non-economists. Significantly, it was on content grounds, not "behavioral" grounds, that economists rejected the objectives.

The emerging form of the hierarchy charts allowed economists to state in creating a chart for a topic, all of the "content" he believed was critical. And there was no requirement placed on the economist that he must state the content in a format resembling a behavioral objective. This would come later, with help from a behavioral specialist.

The economists were asked to generate charts that sought to relate the content items in a hierarchical fashion. Thus, an economist's first-cut, content-only version of a hierarchy chart for a topic would typically have a pyramidal appearance, as indicated in Figure 4. This "topic structure" proved to be an important prerequisite for the next step, specifying the actual behaviors.

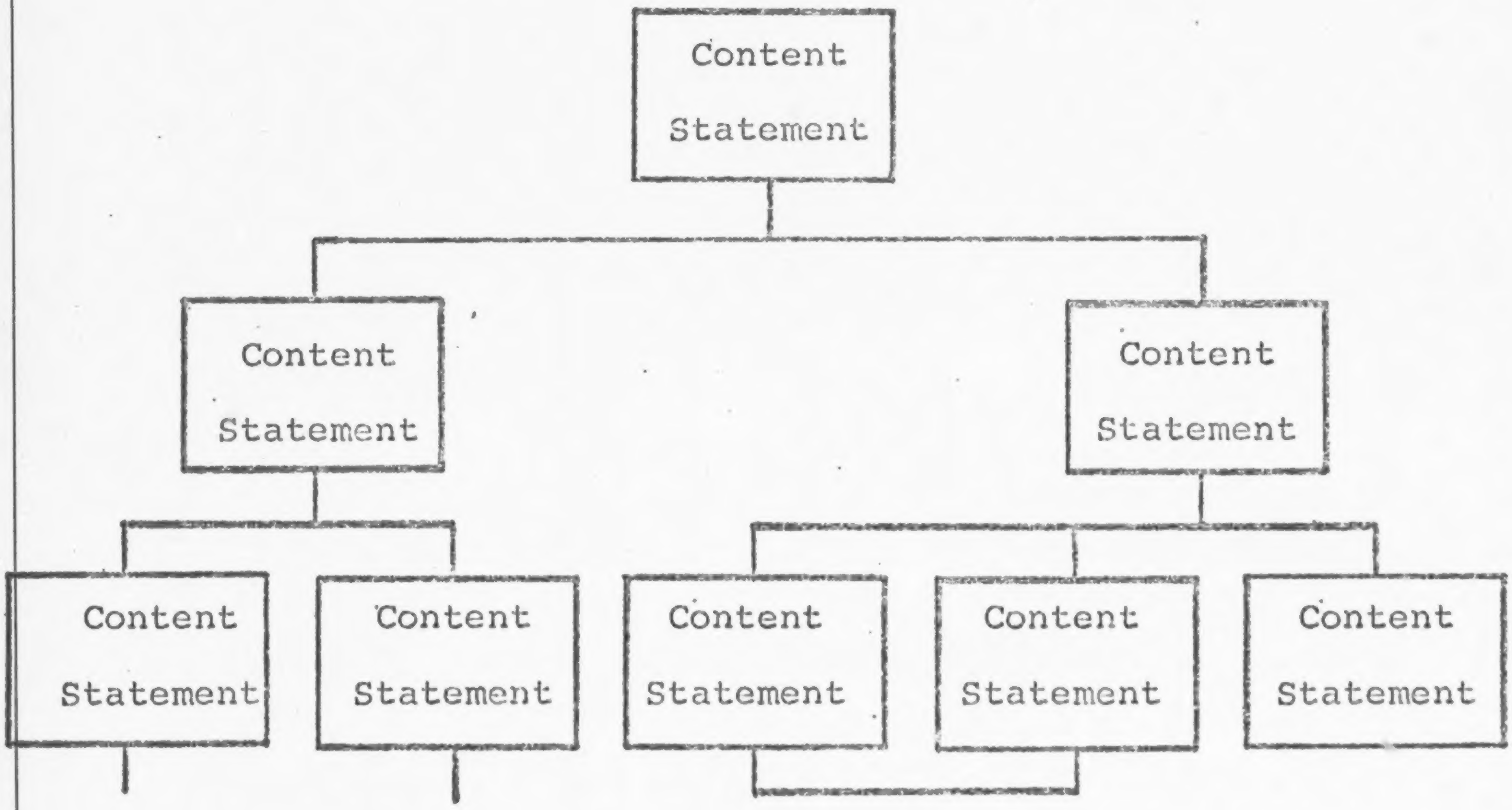
Content Statement
Content Statement
Content Statement
Content Statement
Content Statement
Content Statement
Content Statement
Content Statement

Fig. 4 .--Top three levels of hierarchy chart in early stage of development.

A content-only hierarchy chart produced by an economist might include twenty, fifty, or 100 content boxes. With this preliminary version done, the economist would be joined by a behavioral specialist. The role of the behavioral specialist was to work with the economist to (a) create one or more "behaviors" for each content-box, that would demonstrate that the student "possessed" that content, (b) insure, to the extent possible, that the organization of the chart reflected competency hierarchies, and (c) produce learning time estimates for each box on the chart (since the students had to be able to acquire the behaviors in the learning time available to them).

This working relationship proved to be very harmonious between analysts and economists. Each chart went through many iterations before a balance was found between content, behaviors, and amount of student time allocatable to a given topic. The primary strength of these charts was that they graphically described the status of the development of a topic's specifications at a given time. There was no longer the question of content versus behavior. Both content and behavior were required for every box included in a chart, and while the content was the primary responsibility of the economists, the analyst was held responsible for the quality and integrity of the behavioral components of the chart. A chart served as a constant visual referrent which reflected all decisions to-date for a topic. As such, the charts came to symbolize cooperation and results, and quickly became the primary working document and means of communication between the analysts and economists.

As stated earlier, the senior economists always believed that they were in basic agreement with each other about what the topics should contain--that the lack of understanding of economics on the part of the analysts was the cause of the "acceptance" problem. The hierarchy charts made it possible for a senior economist and a behavioral specialist to mutually approve a chart. When such approval was given, formal behavioral objectives were then written for each box in a chart. Such objectives were carefully reviewed by the cognizant senior economist and others for conformance to the chart and for other characteristics of quality. However, when the behavioral objectives produced in this fashion were reviewed by other senior economists--whether they were on the Center's staff, were outside economics consultants, or were faculty members at the Naval Academy--the objectives were typically criticized on the grounds of content.

It gradually became clear to the non-economist members of the project that no senior economist could happily or comfortably accept completely the behavioral objectives produced by another economist. The extent of the disagreement among senior economists became apparent only when some senior economists, working with analysts, began to "sign off" on specific behavioral objectives. Thus, the conflict shifted to senior economist versus senior economist.

This conflict was never completely resolved. However, it was capable of being controlled, and the hierarchy charts proved to be the basic means of obtaining this control. Once a senior economist agreed on how much student time was to be allocated to a topic, he had accepted a limit as to what the student could be expected to learn during that time. It was recognized that a student could not be expected to learn everything about a topic, all other considerations aside.

The charts came into use as instruments of negotiation between the senior economists. Each box in a chart recorded the learning time for the content-behavior it specified. Once the total learning time in a chart equalled the amount of student learning time allocated to the topic, it was not possible to add something new to a chart without taking something else away. As a result, when a senior economist criticized a chart for not containing something, he was asked to indicate what he would eliminate from the chart so that his desired content could be added.

It soon became apparent to the senior economists that each would have to compromise on what he personally wanted to see in the charts. Behavioral specialists worked closely with the senior economists in effecting tradeoffs that the economists agreed upon. The charts became the documentation of the agreement, not only between the analysts and the economists, but also among the economists. When hierarchy charts had been agreed to in this fashion, general approval of the behavioral objectives produced from such charts became almost automatic. Approval of the charts became almost synonymous with approval of the behavioral objectives.

When it was clear early in approach #4 that senior economists would not accept each other's work products, certain significant changes were made in the project team organization and in the decision-making structure. Strong behavioral specialists were moved into key positions above or equal to senior economists and they were given expanded decision-making authority. This change did not permit the behavioral specialists to dictate content or behaviors. Rather, it gave the behavioral specialists direct control over certain proceedings, including the handling of disagreements among the economists. For example, economists were constantly tempted to go back and revise work done months earlier--including work that they themselves may have already revised two or three times. Management-level behavioral specialists established hard and fast dates after which a work product was "frozen" (i.e., could not be changed except by authority of the Project Director) and otherwise exerted direct control over decision-making.

This organizational change, coupled with the use of hierarchy charts, proved to be very effective. The apparent competitiveness between economist and economist seemed to subside. Behavioral specialists gained increased respect in the eyes of the economists, after having been viewed for so long as the cause of the problem.

Approach #4 was used to complete the task of specifying the requirements for the new multi-media economics course. The approach appeared to be more successful the longer it was used, as team members became experienced in it and made refinements.

Summary of Successful Approach

In summary, a satisfactory, workable method for establishing educational behavioral objectives and for gaining inter-personal and inter-group agreement on them evolved in the project. The elements of this method were as follows:

1. General goals for the course were specified.

2. The instructional topics to make up the course were listed.

3. For each topic, a statement of key points of emphasis and desired areas of content and behavior was prepared as a guide for direction and scope.

4. Maximum student time was determined and allocated to specific topics.

5. A "hierarchy chart" was prepared for each topic, and each box in such a chart included (a) a statement of course content and (b) a statement of one or more behaviors that would demonstrate an understanding of that content.

6. The hierarchy chart for a topic was used as the medium for negotiating differences among decision-makers and for documenting the final forms of the "approved" learning requirements for the topic.

7. Formal behavioral objectives were prepared in conformance to the hierarchy charts.

CHAPTER V

PREPARE TEST ITEMS

There were no major problems encountered in the preparation of test items. The task was performed very similarly to the way in which it was planned. There was, however, a significant rationale employed in task performance that, it was concluded, played an important part in the success of the task. This rationale deserves particular reference.

Rationale for Test Item Design

It was established early in the Project that a criterion test item was to be essentially a "mirror image" of the behavioral objective for which it was prepared and it had to be an objective measure. In other words, the exact criterion behavior specified in the behavioral objective was to actually be a part of the test item. This had the effect of forcing specificity in the behavioral objectives. Every criterion behavior stated in the behavioral objective had to be explicit, measurable, feasible, unambiguous, etc., because that behavior, perhaps exactly as stated, was the "answer" to the associated test item. All behavioral objectives, as a result, provided "answers" (i.e., very explicit descriptions or examples of criterion behavior) which were to be used in the associated test items or used as models for similar responses.

The precision required in no way meant that test items could not sample a behavior that applied to a class of conditions. For example, a behavioral objective might state that the student will be able "to solve equations of the following type," under specified conditions. Examples of the type of equation would have to be provided (with a description of the "correct response" to each such example), along with an indication of the minimum acceptable level of performance and a statement of the conditions under which the student would have to perform. In such a case, test items would be modeled after the sample equations and other information in the statement of the behavioral objective.

Another advantage of the "mirror image" approach concerned the content validity of the test items--in other words, with the question of whether or not the test items were measuring the same behaviors as called for by the behavioral objectives. This approach enabled "face validity" judgments to be unequivocally made by subject matter experts.

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[1] Teaching to behavioral objectives should not be confused with "teaching to the test." It is simple to illustrate the difference. A behavioral objective may specify that the student will be able to add two or more single-digit numbers. A student who achieved this objective will be able to add 1 and 9, 2 and 4, 6 and 3, or any other combination of single digit numbers. In "teaching

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Procedural Considerations

There were, of course, minor procedural changes which took place. The preparation of the first test item at the time the behavioral objective was being prepared was considered to be a very important procedural modification. This seemed to make the process of establishing behavioral objectives a little easier, by helping to establish the nature of the criterion behavior. (In other words, some people can write "good" test questions easier than they can write "good" behavioral objectives. They may prepare test items as a way of "exploring" the kind of behavior that the objective should call for. When they "recognize" what is required, they may then write a behavioral objective that represents a class of feasible test items.)

Three or more criterion test items were prepared for each performance objective. (Figure 5 illustrates a performance objective while Figure 6 gives a criterion test item for the objective.) A criterion test item was intended to answer

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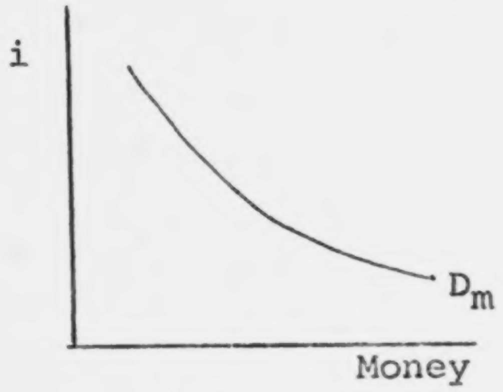
to the test," the student would learn to add only the single digit numbers that appeared on the test. The student might be able to add 2 and 4 but unable to add 2 and 3.

A pool of criterion-referenced test items was prepared for each behavioral objective included in the Multi-Media Economics Analysis Course. Each such test item represented a "sample" of the desired, criterion behavior. From the pool, test items were drawn to construct pre-tests, post tests, and imbedded tests. These tests were used to determine whether or not the student possessed a specified behavior. Instruction is aimed at behavioral objectives. Tests merely measure whether or not objectives are met.

the question: Has the student achieved the related learning objective? The items yielded a yes or no answer for each objective. Test items were subjected to essentially the same type of review process as performance objectives. The test items had to be reviewed and approved by several subject matter experts and a tests and measurement specialist before they were permitted to go into the test item pool. They were also subjected to revision based on student tryout results. Test items were used to construct pre-tests, post-tests, practice tests, and learning-imbedded tests, all of which are elements of the multi-media course.

2753 Conditions: Given alternative graphs concerning total demand for money and asked which graph shows the total demand for money as a function of interest rate for a given level of income,

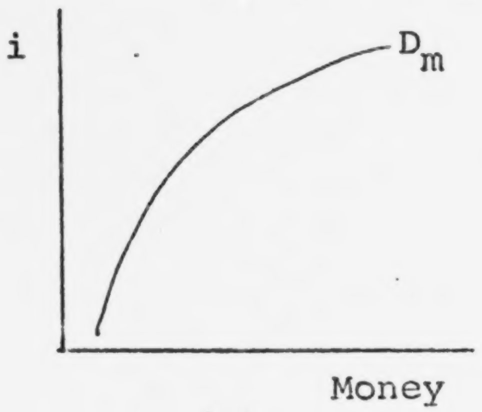
Performance: The student will select a graph equivalent to the following:



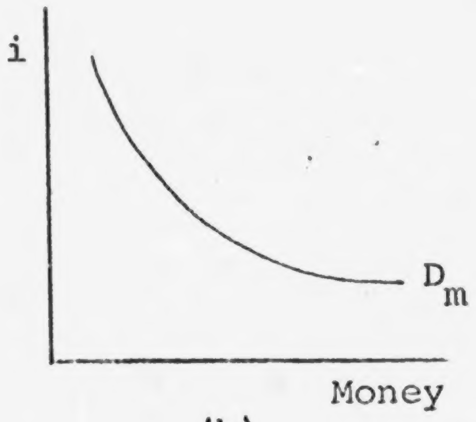
Criterion: Implicit

Fig. 5.--Example of a Performance Objective

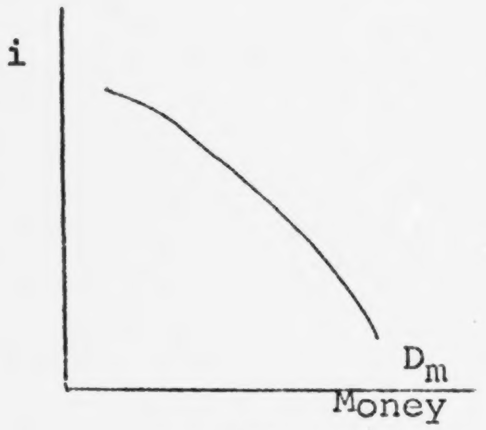
2753 A Which graph shows the correct configuration for the total demand for money as a function of interest rate for a given level of income?



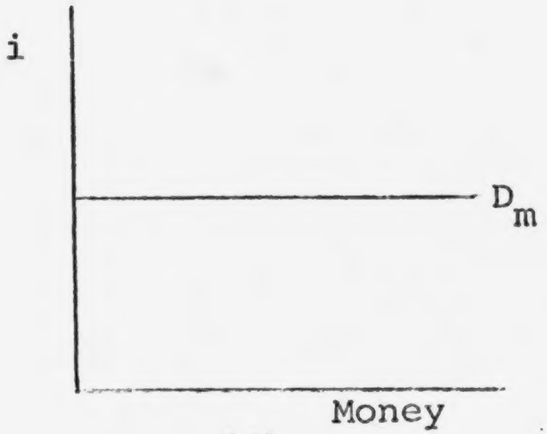
(a)



(b)



(c)



(d)

ANSWER: b

Fig. 6.--Example of a Criterion Test Item

CHAPTER VI

SEQUENCE INSTRUCTIONAL ACTIVITIES

The "sequence of instructional activities" refers to the order in which students interact with units of content. The literature regarding instructional sequencing demonstrates that there are no conclusive data on how it should be done.[1] Heimer, after reviewing sequence theory development, concluded:

> Adequate teaching algorithms which specify the steps to be taken in order to construct an instructional sequence in the presence of a given set of educational ends and a given set of circumstances, and with some assurance of efficiency, do not exist.[2]

Despite the lack of agreement in the literature on how sequencing should be approached or performed, little difficulty was encountered conceptually or operationally in the task performance.

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[1] See, for example, David J. Klaus, "An Analysis of Programming Techniques," Teaching Machines and Programmed Learning, II: Data and Directions, ed. by Robert Glaser (Washington, D.C.: Department of Audiovisual Instruction, 1965), pp. 141-143.

[2] Ralph T. Heimer, "Conditions of Learning in Mathematics: Sequence Theory Development," Review of Educational Research, XXXIX, No. 1, 1969, 506.

The Macro-Planning Chart (described in Part III), prepared in connection with allocating student learning time to instructional topics, proved to be an effective first step in sequencing the instruction. The MPC provided the initial, "general" sequence of the topics expected to be included in the course.

An effective second step in sequencing was the preparation of the hierarchy charts, with their great emphasis on entry-level behaviors, intermediate behavioral objectives, and terminal behavioral objectives. At the point where all hierarchy charts were "approved," the entire course could be viewed as sequenced in a hierarchy of competencies, from the entry-level competencies to the final competencies to be taught in the course.

Sequencing Concept Areas

As would be expected, the relationships among competencies to be learned (behavioral objectives) were not linear. Rather, at the concept area level as well as the topic level, the relationships resembled a series of pyramids. The four major "pyramids" of objectives represented the four major concept areas and were related in the fashion illustrated in Figure 7. Note how the pyramids, or major concept areas, themselves are hierarchically related. It was necessary, it was judged, for a student to achieve the objectives in Concept Area 1 (pyramid 1, Figure 7) before he could begin (possess the entry behavior for) either Concept Area 2 or Concept Area 3 (pyramids 2 or 3). Similarly, it was thought that the student had to have achieved the objectives in both Concept Area 2 and Concept Area 3 before he was qualified to begin Concept Area 4.

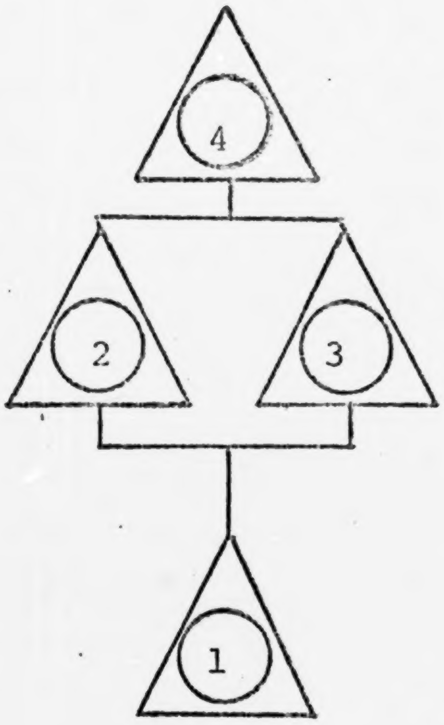

Fig. 7.--Major Hierarchical Groupings of Objectives

In terms of the course presentation, then, a student could study concept areas in either order shown below in Figure 8. While either concept area sequence was theoretically as appropriate as the other, Sequence "A" (Figure 8) was selected for use in presenting the course during the period of the project. The decision not to allow both sequences (i.e., so the student could elect his preference) was made to avoid possible problems during the preliminary presentations of the course. In particular, there was the concern that no avoidable risks be taken in administration while materials were undergoing preliminary testing and validation. The intent was to prevent contaminating the materials-tryout results with negative effects of operational problems.

Concept Area Sequence "A" (Ascending Order)	Concept Area Sequence "B" (Ascending Order)
4	4
3	2
2	3
1	1

Fig. 8.--Alternative Sequencing of Concept Areas

Sequencing Topics

As suggested by the pyramids in Figure 7, each concept area consisted of hierarchically-related topics. Many possible sequences of topics existed for each concept area. Again, for very practical considerations, decisions were made to select only certain sequencing alternatives for use in the course. It was concluded that it would not be feasible to provide all possible topic-sequencing options, considering media-materials logistics, student management, and other factors. The same concern with avoiding risks of administrative problems during materials testing also prevailed.

Sequencing Remediation

The decision was made during pre-contract planning that the function of remedial learning was to support core learning. Two types of remediation were considered possible, "prerequisites" remediation and "regular" remediation.

Prerequisites remediation had to do with assumptions about entry behavior. Let us say that we assume in the course that all students can use graphs in some specific way. Through a pretest, we may find that some few students cannot use graphs as assumed. A "prerequisites" remediation topic (e.g., "Using Graphs") might be necessary for this situation.

Regular remediation had to do with learning problems encountered by students who apparently had the prerequisite behaviors. An example might be the case where a student had difficulty in solving a problem of a given type. He may be referred to a "regular" remediation package that teaches the desired problem solving behaviors in a different style or at a lower level of difficulty than in the original learning activity.

The Macro-Planning Chart had set aside an average of about three hours per week for prerequisite or regular remediation. However, no remediation "topics" of any kind were assigned to the segment buckets in the Macro-Planning Chart. It was believed to be impossible to judge in advance, with any acceptable degree of accuracy, either the prerequisite or the regular remediation requirements. It was decided that the more cost-effective approach would be to empirically determine the remedial learning requirements.

While no remediation topics were specified, a remediation option was left open following each pretest (prerequisite remediation) and each post test (regular remediation).

Sequencing Enrichment

Enrichment learning objectives were not, in the main, defined in a separate task from determining the core learning objectives. As described earlier, it proved to be very difficult to keep the size of the course, as implied by the behavioral objectives specified, within bounds. It was estimated that sufficient behavioral objectives for a five-semester economics course were generated. About two semester's worth were selected to be the "core" objectives of the Multi-Media Economic Analysis Course. Many enrichment objectives were selected from the remainder. Other enrichment objectives were developed specifically as "enrichment."

In the MMCD Project, the behavioral objectives were stated at a very specific level, requiring perhaps ten minutes, in most cases, for a student to achieve the objective, assuming he had the prerequisite competencies. It was not possible to pick this isolated objective and that isolated objective, etc., and call them "enrichment." There had to be a valid "behavioral path" to every objective in the course, which meant that all prerequisite competencies to achieving an objective, whether it was core or enrichment, had to be provided. Thus, enrichment objectives also had to form "instructional topics," and either a core segment or another enrichment segment provided the entry behavior for a given enrichment topic. As with core topics, an enrichment topic could require one or more segments. The sequencing of the enrichment was based on such dependency relationships.

Sequencing Other Activities

The sequencing activity also included determining when pretests and post tests should be given, when counseling should be available, and what options existed for the student at specific points in the course. Sequencing decisions were recorded in the form of a "Micro-Sequencing Chart" for each concept area. Figure 9 shows such a chart.

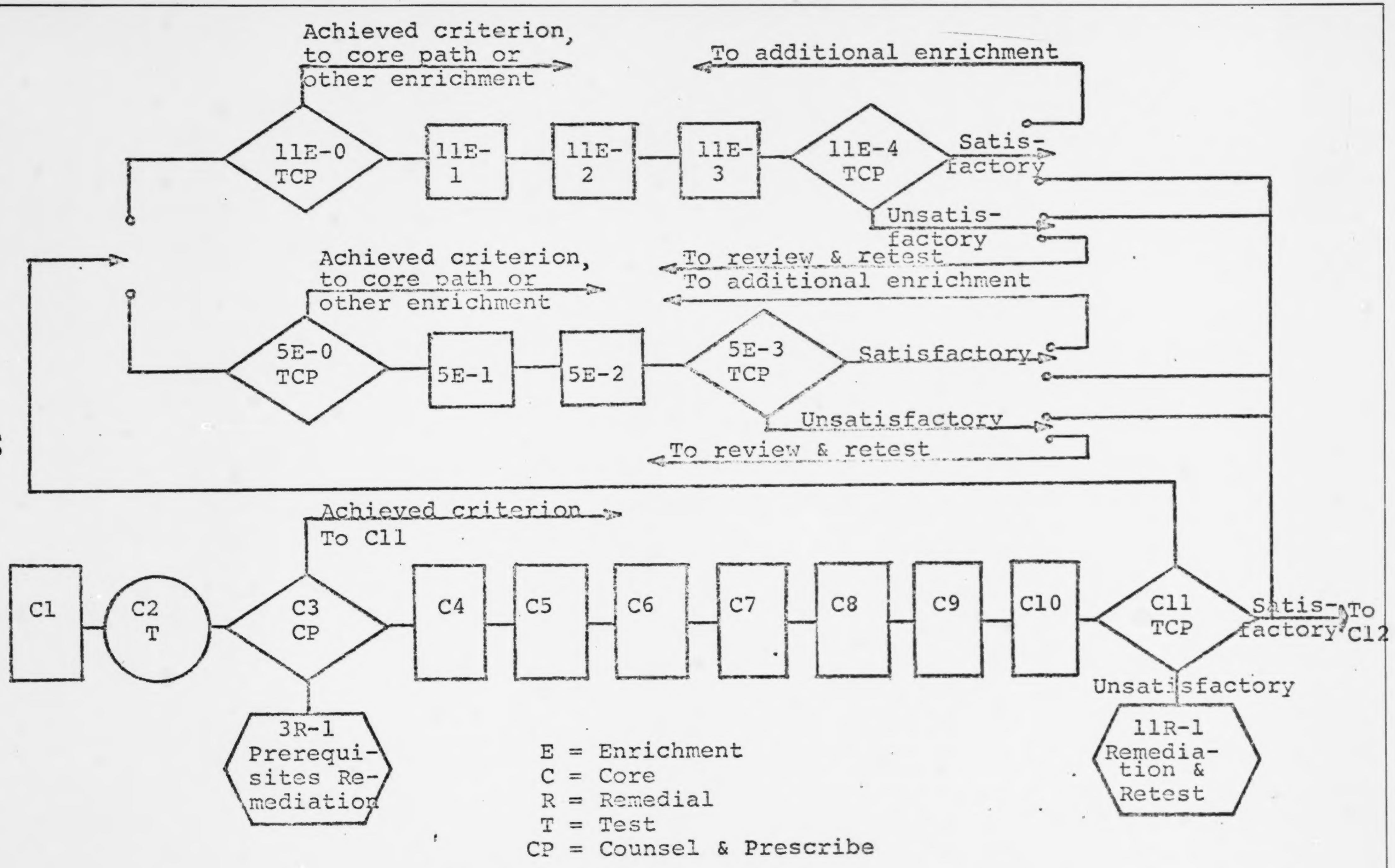
Achieved criterion, to core path or other enrichment
To additional enrichment
11E-0 TCP
11E-1
11E-2
11E-3
11E-4 TCP
Satisfactory
Unsatisfactory
To review & retest
Achieved criterion, to core path or other enrichment
To additional enrichment
5E-0 TCP
5E-1
5E-2
5E-3 TCP
Satisfactory
Unsatisfactory
To review & retest
Achieved criterion To C11
C1
C2 T
C3 CP
C4
C5
C6
C7
C8
C9
C10
C11 TCP
Satisfactory
To C12
Unsatisfactory
3R-1 Prerequisites Remediation
11R-1 Remediation & Retest
E = Enrichment
C = Core
R = Remedial
T = Test
CP = Counsel & Prescribe

Fig. 9.--Micro-Sequencing for Concept Area One

In the Micro-Sequencing Chart shown in Figure 9, the first segment (C1) was a group orientation session. The second segment (C2) was a pretest, the third segment (C3) was a counseling session, when pretest scores and learning contracts were discussed, the fourth (C5) was a self-instructional segment, and so on. If the student progressed at an acceptable rate, when he passed the post test of segment C11, he had an option of taking certain enrichment segments or continuing on to more core segments.

No matter how far a student progressed in the course, as long as his rate of progress was acceptable, he could exercise his option to take any enrichment material he had earlier decided not to take. This "continuing option" is not shown in Figure 9. Also, neither the "student-generated" enrichment learning activities nor the "instructor-generated" enrichment learning activities are represented there. Such enrichment was to be generated during the course, to be responsive to the special needs or desires of groups of students or individual students. This type of enrichment tends to revolve around issues that are currently making headlines, which the students perceive as "relevant."

CHAPTER VII

SELECT THE MEDIA

Very little has been produced in the past fifty years concerning when to use what instructional media. In his review of instructional design and media selection factors Saettler points out that the predominant type of media study conducted has been the media comparison study, usually yielding a finding of no significant difference.[1] He concurs with the observations by Knowlton that these studies were not actually research on media because their experimental designs did not provide for separating the physical characteristics of the media from the sign vehicles of the message they carried.[2] Lumsdaine and May in their review of media research have stressed the inherent limitations of such media comparision studies.[3]

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[1] Paul Saettler, "Design and Selection Factors" Review of Educational Research 38: 115-128; April 1968.

[2] James Q. Knowlton, "A Socio- and Psycho-Linguistic Theory of Pictorial Communication" (Bloomington: Indiana University, Division of Educational Media and Audio Visual Center, 1964).

[3] A. A. Lumsdaine and M. A. May, "Mass Communication and Educational Media," Annual Review of Psychology, XVI, (1965), 475-534.

A monograph by Briggs and others reviewed media research and commented in some detail on its shortcomings.[4] Studies were classified into (1) comparative effectiveness studies, (2) utilization studies, and (3) basic studies, for each of seven classes of media. As to the value of the research findings in making specific media choices, it was concluded that "neither laboratory nor media studies has provided complete enough information to eliminate the uncertainties involved in making such choices...neither the learning psychologist nor the classroom teacher can justify such decisions entirely on the basis of present research evidence."[5]

A significant step in the direction of developing a comprehensive and systematic media selection procedure is seen in the work of Gagné and Briggs. Gagné developed a hierarchical model of eight types of learning, and defined the particular conditions (of learning) found necessary to facilitate each type.[6] Media are to be selected which can best produce the conditions of learning required. It is assumed that different media would be required to produce different conditions of learning.

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[4] Leslie J. Briggs., _et al._ _Instructional Media: A Procedure for the Design of Multi-Media Instruction, A Critical Review of Research, and Suggestions for Future Research,_ Monograph No. 2 (Pittsburgh: American Institutes for Research, 1967).

[5] _Ibid._, pp. 137-138.

Briggs developed a procedure, based on Gagné's model, which called for analyzing behavioral objectives to identify the types and conditions of learning involved, determining the instructional events that would provide the desired conditions of learning, and then matching the characteristics of the instructional events with the characteristics of media.[7] The procedure described by Briggs was attempted in the Multi-Media Curriculum Development Project.

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[6] Robert M. Gagné, The Conditions of Learning (New York: Holt, Rinehart and Winston, Inc., 1965).

[7] Briggs, et al., Instructional Media.

Problems Encountered

The original media-selection plan was found to have deficiencies as applied in the project. It may be of interest to summarize the problems encountered before describing the new plan that emerged.

The effect of using the media-selection plan was to cause media that were "not preferred" to be eliminated from consideration, while leaving a group of acceptable media or media-mixes from which the final selections had to be made. In the media-selection analysis, however, an unacceptable medium or media-mix could become acceptable simply by adding a supplementary medium or otherwise changing the media-mix. Many permutations were possible.

There was always the question of where to draw the line in terms of different mixes that might be considered. For example, assume a CAI carrel included a cathode ray tube, a slide projector, an audio output device, a hardcopy output device, a keyboard input, a light pen input, and some pre-printed material for the student. Such a carrel alone could result in over one hundred different possible media-mixes. Thus, there was always an ample supply of media combinations that could provide satisfactorily for particular conditions of learning.

Another factor in the media-selection analysis was the homogeneity of the learning conditions that seemed called for throughout the various parts of the course. This seemed to be the logical result of the great similarity in the characteristics of the content and what students were to do with it (i.e., the behaviors) from segment to segment of the course. Accordingly, it was possible, if one chose to do so, to select a single media-mix, from among the alternatives available, for use in rather lengthy sequences of instruction.

It also became clear that there had to be "trade-offs" made throughout the course, since resources are not unlimited. For example, media "A" may cost twice as much as media "B" (actually, the cost ratio can be fifteen or more to one), and it will be "better," we judge, than media "B." Questions arose, such as: (1) regardless of value, is there enough money available to even consider media "A"?, (2) how much "better" does a medium have to be to justify paying twice the cost (and what criteria, with what reliability, should be used in making the decisions), and (3) should resources be evenly devoted to mediating the different parts of the course or is it better to concentrate resources on mediating a portion of the course, to produce the greatest average learning.

Still another factor was that the plan seemingly did not give sufficient emphasis to the administrative-operational setting in which the course would be presented. All told, it appeared that the original media selection plan focused largely on the theoretical aspects of learning, somewhat at the expense of environmental factors that can have a major effect on the learning outcomes.

The New Scheme

It was concluded that the media selection plan originally proposed did not go far enough. In general, it seemed that the scope of variables implied by the original plan was too narrow, and there was no mechanism to weight the variables in terms of their relative importance. As a result, the media selection approach underwent a revision. A two-step media selection plan emerged.

Media selection criteria were derived from the variables which would determine media "effectiveness." One class of criteria was derived from the requirements of specific learning situations, and these may be called the "micro" criteria. A second group of criteria, often overlooked, was derived from the general environment in which the learning situations were to be provided. These may be termed the "macro" criteria.

Step 1. Micro-Criteria Analysis

There were several steps in this analysis, which was directed toward determining which classes of media could be used in particular instructional sequences. This analysis assumed that performance objectives had been explicitly defined and sequenced and that the sequencing (or sequences) reflected hierarchies of competencies called for by groups of objectives. The analysis began by examining each individual objective in a sequence to determine the basic requirements of the learning called for. This analysis sought to determine the specific stimulus requirements, response requirements, and other requirements for producing the desired learning.

Theoretically, these requirements for learning, as determined by this analysis, had to be provided for through the instructional strategy, if the learning was to be efficient or to take place at all. The major parts of an instructional strategy included (a) the characteristics of the message to be presented; (b) the characteristics of the possible responses from the student, including the desired response; (c) the requirements for receiving and analyzing the adequacy of the response; (d) the characteristics of the feedback to the student; and, finally, (f) the technique of programming all of these. Categories (a) through (d) above were the "requirements for learning" that the micro-analysis sought to determine, since they established what capabilities the selected media must have. In other words, they produced the micro-criteria for use in the media selection process. Figure 10 gives examples of the kinds of micro-criteria that may be produced.

The result of the micro-criteria analysis was a statement of the media capability requirements. (A distinction was made between the absolute requirements and the "nice-to-have" capabilities--an attempt was made to never confuse the two.)

A list of types of media feasible for consideration in the learning program was compiled. The major characteristics of classes of such media were then delineated. At this point, it was possible to compare the media capability requirements with the characteristics of media feasible for consideration. This produced two groups of media, one that was "acceptable" and one that was "unacceptable," based on attempts to match requirements with capabilities. This concluded the micro-criteria analysis.

Before describing the next step, a comment is in order. The more logically appealing media selection approaches call for an analysis that is conceptually similar to that described above. Some specify that an analysis of great depth and detail be conducted, while others are much less demanding.

A. Stimulus Characteristics
    1. Visual
        a) Black and White
        b) Color
        c) Still
        d) Motion
    2. Aural
        a) Voice grade
        b) Hi-fi
    3. Referability
    4. Three-dimensional
    5. Coding complexity

B. Response Characteristics
    1. Spoken
    2. Written
    3. Covert
    4. Practice
    5. Creative
    6. Time factors

C. Level of Abstraction
    1. Real
    2. Synthetic
    3. Symbolic

D. Media Function
    1. Present stimulus
    2. Direct attention
    3. Provide model of expected performance
    4. Furnish external prompts
    5. Guiding thinking
    6. Inducing transfer
    7. Assessing attainment
    8. Providing feedback

E. Type of Objective
    1. Core
    2. Remedial
    3. Enrichment

F. Learning Situation
    1. Group
    2. Individual

Fig. 10.--Micro-Criteria For Use in Media Selection

All of these approaches, though, are trying to make some sort of effective match between the learning conditions and the media characteristics. But it is at this stage in the media selection approach that the process seems to break down. Having isolated a group of media which at least theoretically could meet the requirements for a given instructional sequence, it would appear that selections could now be made, taking into account basic considerations of price and durability, and that one could be confident of the result. The result, in fact, could be failure of the media strategy and the learning program that used it.

Approaches which go little or no further than what has been termed the micro analysis are essentially seeking to optimize at the subsystem level. (In other words, much like strengthening one link in a chain without knowing how strong the other links are.) Such approaches court failure by ignoring or only making passing mention of the general environment in which the learning is to be provided. To ignore the broad context or general environment, from which important media selection criteria may be derived, is to seriously endanger the success of any media selection scheme. The next step dealt with such environmental considerations.

Step 2: Macro-Criteria Analysis

Macro-criteria were derived from elements of the general environment in which the learning was to be provided. The relationship between the micro-and macro-criteria and how they were derived is illustrated in Figure 11. The figure also shows that micro-criteria produced candidate media, but the final selection from among the candidates was done using the macro-criteria. The first major consideration in deriving macro-criteria was the "level of concern," since it was a basic requirement in identifying the goals, resources, and constraints that could affect media selection and utilization.

Level of Concern

The level of concern for media decision-making may be a single concept, a single lesson, a complete instructional unit, a complete course, or for that matter, a department or an entire school. The higher the level, the broader the goals are, the more resources that can be applied, and the fewer constraints that cannot be relaxed. Goals of the school have an impact on the goals of the division, and the division's goals give general direction to the department's goals, and so on. Goals determine how resources will be allocated and, therefore, they influence the constraints that will pertain to the media program. Formal and informal administrative policies and

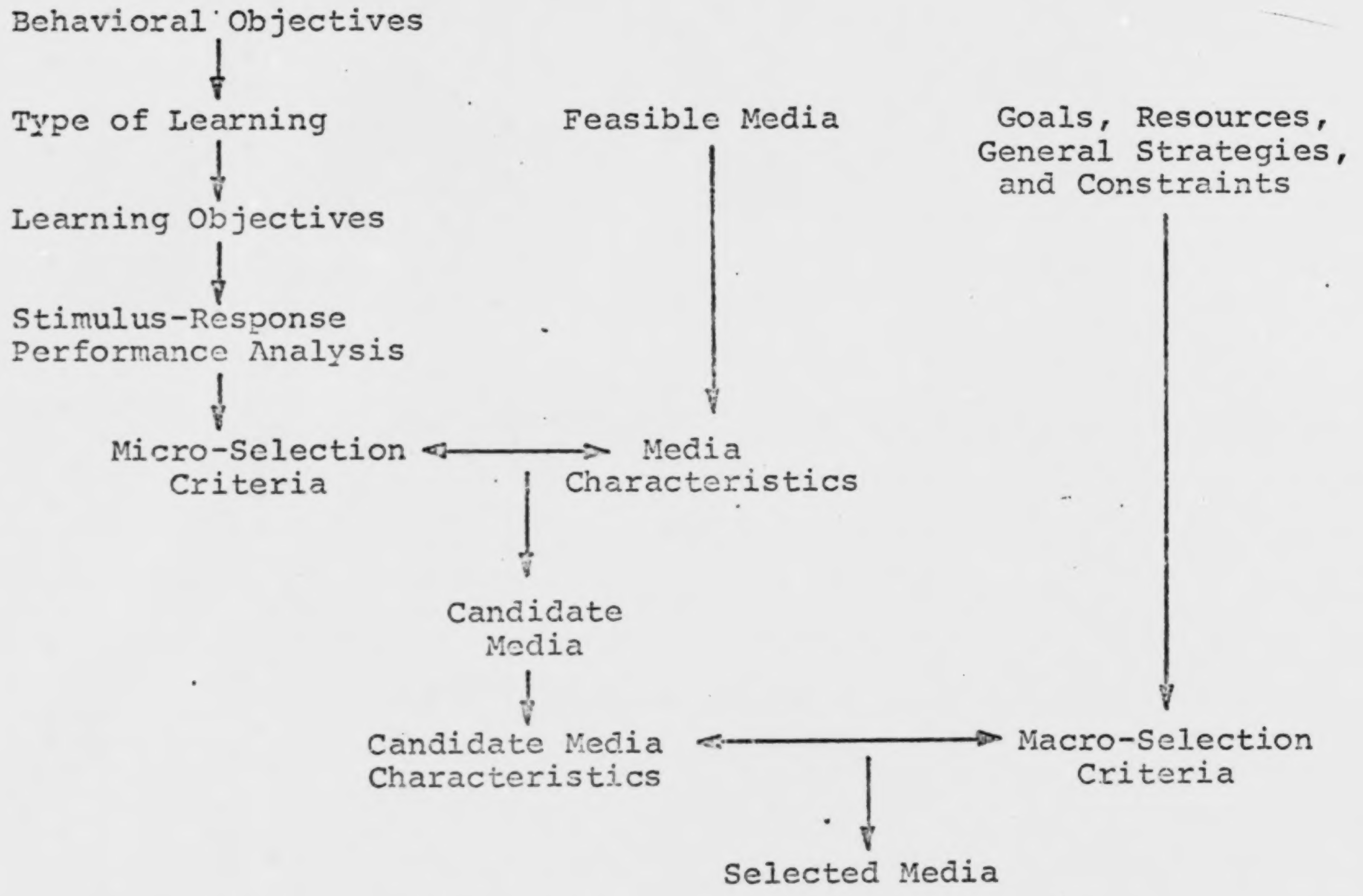
Behavioral Objectives
Type of Learning
Learning Objectives
Stimulus-Response Performance Analysis
Micro-Selection Criteria
Feasible Media
Media Characteristics
Candidate Media
Candidate Media Characteristics
Goals, Resources, General Strategies, and Constraints
Macro-Selection Criteria
Selected Media

Fig. 11.--Media Analysis and Selection Process

practices reflect goals, and the success of the media program is going to depend in large part on how it supports the goals of the next higher level. Obviously, if a planned media program for a department is at odds with explicit or implicit division policy, it is highly probable that the program will encounter some significant obstacles.

There is little value, for example, in someone specifying media for a self-instructional program if this type of program is unacceptable at the school in the first place. Conversely, one may find that he is selecting media for a demonstration project which could lead to an entire school system adopting a self-instructional course in a given subject. The policy on expansion and dissemination of the results of a media selection-utilization project should be clearly understood.

Being attentive to the level of concern in the MMCD Project helped to determine the written and unwritten policies and goals within which the media program would operate. To the extent possible, all pertinent policies and goals were made explicit for purposes of media planning. In some areas, there was no identifiable policy, and the media planner had an opportunity to influence its formulation at the appropriate time.

Clearly identifying the resources available for media utilization was equally important. The resources available were often not immediately apparent. It was important to differentiate between resources required to initiate a media strategy and the resources required to operate it. (If materials are going to be produced for sophisticated equipment, for example, then a great deal of funds may be required to provide the program.)

Some media programs can be very costly to maintain (e.g., those using computer-assisted instruction). Types of resources that were considered include the following:

- Funds available--what sources, how probable that they will actually be provided, what dates will they be available, etc.
- Personnel available--who are they, can the release date be guaranteed in writing, what are their interests and capabilities, part-time or full-time, etc.
- Time available--when is the media program required, what target dates must be met, etc.
- Hardware available--what media are now available here or from elsewhere, what is lease price versus purchase price, what information services and other services are available for the media, are special skills required to operate the media, what are operational capabilities, procedures, and costs, etc.
- Software available--what materials are available here or elsewhere for the different media, at what cost and with what quality, what materials would be useful if modified, etc.

Constraints are more or less the opposite side of the resources coin. While the lack of a needed resource in sufficient quantities is a constraint, it was also important not to take certain things for granted and, as a result, fail to uncover significant obstacles. One may be interested in innovative programs, for example, but the rest of the faculty might like the current approach.

Programming Strategy

Another key source of macro-criteria was the instructional programming strategy. It was almost impossible to consider programming strategy without classes of media coming to mind. Once a decision was made on programming strategy, though, some media were automatically ruled out. Similarly, once the media were selected, certain programming strategies could no longer be considered. For example, computer-based simulations were selected to demonstrate to students how various concepts and principles relate to each other in an econometric model under conditions which the student himself may vary. Many variables may be handled and the relationships among them may be extremely complex, yet the model can be easily and quickly manipulated by the student at a computer terminal. This programming technique might never have been considered by someone completely ignorant of computer capabilities. Thinking imaginatively about how specific media could be used helped to develop new programming approaches, and as many alternative approaches as possible were generated and considered before the final selection was made.

An important point is that all programming approaches considered had to be compatible with the stimulus-response-feedback requirements that grew out of the analysis of the performance objectives. And of equal importance was the requirement that they reflect the characteristics of the target population of students. Alternative programming approaches had to be analyzed in relation to these and other factors constituting the overall instructional strategy. The various factors, of course, were interactive, so the selection of the final "configuration" of factors was done through an iterative process. This process was directed toward meeting the performance objectives in the most cost-effective manner and within the framework of the policies and goals that prevailed.

Instructor-Student-Media Interactions

The importance of defining selection-utilization criteria that will generate acceptance of the new media strategy has been demonstrated by the number of media programs which have failed in their initial stages because the faculty or students involved did not like them. The matter of instructor-student-media interaction, which is the primary basis for acceptability or non-acceptability, was dealt with in the final step of the macro-analysis. It was a critical part of the overall instructional strategy.

Acceptance Interrelationships.--It was very important not to ignore that students and teachers have opinions and attitudes--sometimes very strong ones--regarding the appropriateness of various instructional media. The grades that a student has been getting will influence his media likes and dislikes. (The ghetto child, for example, may have entirely different perceptions of specific media and the role they should play than the suburban child.) Also, the teacher will have his own criteria as to what constitutes "acceptable" media. He may believe that the purpose of media is to help him to teach better and be concerned about attempts to "replace the teacher" in some media applications. Or he may be eager to experiment with new approaches and new roles. Teachers will differ somewhat as to viewpoint, but as a group their attitudes toward a new media program can grow more positive or more negative, depending on how they are personally affected.

A new media program involves the students and the teachers. If the nature of this involvement is disliked by either party, the success of the program is jeopardized. If the students do not like the program, negative comments will soon be heard from the teachers. And, certainly, if the teachers are unhappy in their roles, this attitude is highly likely to pervade the student group. It is important, then, to take account of student variables which can promote acceptance on the part of the students and define a role that is acceptable to the teacher.

Student Variables.--Many student variables entered into the planning and decision-making for a media strategy. Many of the same variables important to the design of instructional messages were considered because it was necessary to avoid media that could constrain or otherwise affect the message in undesired ways. Media which did not distort the message but, rather, facilitated its delivery under the required conditions were preferred.

Instructor Variables.--The instructor variables were of a somewhat different kind but were considered equally important for a new program to be successful. The primary question was what role the instructor would play in a new media strategy, and this, it was thought, would depend on many factors. The following were considered:

- How much total time would the instructor spend with (a) students individually and (b) groups of students?
- What activities would he be engaged in, as a percentage of the total time?
- Would his role have more prestige and/or more pay than the conventional role?
- Are the instructors qualified to fulfill the requirements of the role?
- Can the instructors learn any necessary new skills under the conditions (time, money, etc.)?
- Will there be an increase or decrease in the overall workload of the instructors?
- How much freedom and decision-making authority will the instructors have in the new program?
- How much confidence do the instructors now have that a proposed student-media-materials logistics plan will be adequately supported by the school administrators?
- What is the media history of the school (e.g., have media been available and have they been used)?

This list could be made quite lengthy, but it should be sufficient to illustrate some factors considered to be important in gaining teacher acceptance.

Any proposed media program can cause anxiety among teachers who are uncertain as to how they might be affected, particularly if self-instructional media are involved. It is understandable that a new media program may be seen as a major threat by the teachers and be in various ways resisted until an acceptable role for teachers has been defined and communicated to the teaching staff.

Utilization of Macro-Criteria

The macro-criteria that were derived in the MMCD Project are summarized below. (In another situation, other macro-criteria may be more important.) In reviewing these criteria, it is easy to recall media that might be acceptable or unacceptable in terms of a single criterion. Certain media, however, will meet a given criterion better than some others, or for less implied costs than others.

- Self-pacing--high priority must be placed on students proceeding at their own pace.
- Self-management--within broad limits, the student should be able to manage his own time and exert control over his own learning situation.
- Cognitive structure--it is desirable to be able to demonstrate patterns and inter-relationships in problem-solving, real-world simulation circumstances.
- Motivation--the management of motivation should be enhanced by media (i.e., the media must reflect student characteristics).

- Administration-operation--the media strategy must fit within the administrative and operational constraints imposed by the environment.
- Acceptability--the media strategy must be acceptable to the faculty who will be affected and to the students for whom it is intended.
- Implied costs--the implied costs of the media strategy, for both development and utilization, must be within the reach of available resources.
- Novelty--the novelty effect of certain media or media sequences should be exploited (a simple change of the media is often refreshing and motivating to the student).
- Sequencing--media usage by the student and transitions from one medium to another must appear unhurried, smooth, and rational to the student.

The macro-criteria that should be employed will vary from situation to situation, simply because the variables will differ between situations. This is important, since what is desired is a media program that will meet the requirements of a given situation. The list of specific variables that could be important at the macro level could be quite lengthy.

In the MMCD Project, care was taken to properly weight the variables in accordance with their probable contributions to media effectiveness. For example, "acceptability" of the media strategy to faculty and students was considered critical in the MMCD Project, and selection criteria required to insure such acceptability was heavily weighted.

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CHAPTER VIII

PREPARE MATERIALS

In a review of the research on curriculum materials, Popham distinguished between projects that produced admonitions and projects that produced materials, stating:

> To state it bluntly, it takes more than admonitions from curriculum seers, even if they are accompanied by polished curriculum guides, to alter the procedures of busy educational practitioners. The educational reformer who eloquently urges classroom teachers to change their practices may receive the accolades of the educational community, but the educational reformer who provides a set of usable curriculum materials for the teacher is more likely to modify what goes on in the classroom.[1]

The preparation of materials concerned four critical activities:

1. Developing the presentation-feedback strategy for each media-mix selected
2. Generating materials specifications
3. Producing the materials
4. Trying out the material with students and revising it as indicated by an analysis of the empirical results.

These activities had to be effectively performed within hard and fast time limitations. On a specific day, the semester would begin, the students would arrive, and the Multi-Media

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[1] W. James Popham, "Curriculum Materials," Review of Educational Research, XXXIX, No. 3 (1969), 319.

Economic Analysis Course had to be "ready" for them. "Ready" meant that confidence in its instructional benefits had already been obtained through preliminary testing. This, in turn, meant that one to two hundred student-hours of material had to be generated and reach a "pre-validated" form during about a three-month period.

Presentation Strategies

It was decided that Gagné's theoretical descriptions of conditions of learning for types of learning would serve as general models for the presentation strategies of the media.[2] This meant that, as a first step, the type of learning called for by each behavioral objective in an instructional segment had to be determined. Each "segment of objectives" was carefully reviewed and each objective labeled with an identification of one of Gagné's eight types of learning.

The great preponderance of objectives was judged to be Type 8 (Problem Solving) and Type 7 (Principle Learning), the two highest types of learning according to Gagné's hierarchy. Type 6 (Concept Learning) was third in frequency of usage and Type 5 (Multiple-Discrimination Learning) was fourth. None of the objectives was judged to be Type 1 through Type 4.

For purposes of materials development specifications, it proved to be difficult and impractical to differentiate between Principle Learning and Problem Solving. In other words, it was difficult to find general criteria for the materials developers to follow which would adequately differentiate between how materials should be developed where

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[2] Robert M. Gagné, The Conditions of Learning (New York: Holt, Rinehart and Winston, Inc., 1965).

Principle Learning is called for versus where Problem Solving is called for. There is as much variability in learning within each of these two types of learning as there is between the two types.

There are "simple" principles and there are "difficult" principles. Similarly, there are "simple" problems to solve and there are "difficult" problems to solve. The amount of guidance required can vary within either type of learning. Gagné anticipated some difficulty of this type when he stated:

> In a fundamental sense, the capability learned by problem solving (Type 8) is no different from that which may be learned by combining subordinate principles in the manner described as Type 7 learning. Both kinds of learning result in the establishment of higher-order principles. The two kinds of learning appear to differ only in the nature and amount of guidance provided by verbal instructions.[3]

As a result, the materials specifications combined Types 7 and 8 learning into one explanation of conditions of learning, i.e., into one learning paradigm. In applying the guidelines that were a part of the explanation, the individual materials preparer was given room for exercising his best judgment and for being creative in applying the paradigm in producing materials.

The conditions of learning, then, were translated into learning paradigms for types of learning. These paradigms were not given to the materials developers.[4] Rather, the paradigms were used to prepare examples of learning materials that embody the paradigms, and these examples were given. Three materials samples were prepared for the use of the materials preparers. Sample A concerned higher-order principle learning (Type 8 - Problem Solving and Type 7 - Principle Learning); Sample B concerned Concept Learning (Type 6); and Sample C concerned multiple-discrimination learning (Type 5). Materials developers were informed that Sample A was to be generally followed for all objectives labeled "A," Sample B for all those labeled "B," and Sample C for all those labeled "C."

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[3] _Ibid._, p. 164.

Translating the learning paradigms to materials samples, however, required a number of decisions on treatment variables. Decisions had to be made concerning:

- Use of "Organizers"
- Step Size
- Relevant Practice
- Knowledge of Results
- Sequencing within segments
- Formatting
- Pacing

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[4] Phrases such as "learning paradigms" were rarely used in communication with materials prepared or with anyone who was not a part of the project team.

The learning paradigms (based on Gagné's descriptions of conditions of learning) implied the use of "organizers" to focus attention, indicate relevance, provide perspective, give a "roadmap" of the planned learning path--all directed toward facilitating transfer and otherwise increasing the efficiency of learning.[5] There is evidence that the use of organizers can markedly increase learning efficiency.[6] Organizers were used in introducing the learning, during the learning, and following the learning.

The decisions to be made on "step size" were considered crucial to the ultimate appropriateness and acceptability of the materials. Briggs points out that there is no common understanding of what "step size" means:

> There is no standard definition of "size of step." In programed instruction it has referred variously to (a) how difficult a response is to make, (b) how large a reading segment is presented before a response is required, (c) how much progress toward the goal is represented by one frame, (d) how long it takes the learner to make a response, (e) whether or not the student responds correctly, and (f) how frequently reinforcement occurs.[7]

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[5] Ibid.

[6] See the review by Popham, "Curriculum Materials," 323; also see Arden Grotelueschen, "Effects of Differentially Structural Introductory Materials and Learning Tasks on Learning and Transfer," American Educational Research Journal, V (1968), 191-202.

[7] Leslie J. Briggs, "Learner Variables and Educational Media," Review of Educational Research, XXXVIII, No. 2 (1969), 165-166.

In the MMCD Project, "step size" was defined as the amount of learning required by the student to proceed from achieving one behavioral objective to achieving the next behavioral objective in the same learning sequence. Thus, "step size" was related to measurable behavior change. As indicated below in the discussion of pacing, the students were nevertheless individually given much control over the "step size" they actually used.

Relevant practice was imbedded in the learning material for every objective, whether an intermediate behavioral objective or a terminal behavioral objective. Moreover, self-tests were strategically inserted in learning sequences, which had the dual benefit of giving the student feedback on his performance and letting him further practice the correct performance. About three or four practice situations (usually problems to solve) were included in a ten-minute learning sequence for a behavioral objective. The next behavioral objective in the hierarchical learning sequence would, in its instructional material, build on the just-learned behavior, often providing additional practice of the previous behavior or otherwise reinforcing that behavior. At the end of an instructional segment (about fifty minutes average learning time, but with great individual variation in time), the self-test provided additional practice of desired behavior taught in the segment.

Knowledge of results, it was concluded, should be provided as soon as possible. A student response board was, therefore, among the media selected. This device is used by the student during the majority of instructional sequences when the medium is not one or more humans (such as in counseling sessions or seminars). The board gives him immediate feedback on his practice problems and on all self-tests (as he is taking each test). In the event a student's response is incorrect with regard to a given problem or test item, he is expected to follow the suggested learning prescription associated with the incorrect response.

Sequencing within individual segments did not involve difficult decisions. A typical instructional segment might include from six to ten behavioral objectives. Individual materials preparers prepared complete segments (and, in some cases, complete topics having a number of segments). If the relationships among the behavioral objectives in a segment allowed for some minor sequencing options, the materials preparer was generally given the freedom to select the option that most suited him and any creative ideas he had in mind.

Formatting decisions were considered to be of very great importance. The "format" included the physical layout of the printed page, the tone and rate of the spoken word in an audio tape, the nature of a computer printout, and a host of general considerations regarding these and other media.

It was believed that a "pleasing" image was important for the materials, that its absence would have a negative effect on the learning. It was not concluded that materials had to be elaborate.

Since one of the major objectives, of course, was to individualize instruction, it was decided that the student should largely control his own learning pace, provided he is progressing at the minimum acceptable pace. In order to facilitate such self-pacing, the learning materials were to be prepared so that a student could use them at different rates and amounts of interaction. (It was felt that a student should be able to use the materials as best suited his own "learning style.) Accordingly, it was decided to have a "high speed" path through the materials, plus a slower, highly structured path. Also, it was decided to provide for multiple entry points in the material and to allow the student a degree of control over the sequencing of the instructional events he participated in.

Materials Specifications

It was concluded that the only way in which the materials preparation schedule could be met was through a massive "parallel" production of virtually the entire 100 to 200 hours of the course. The schedule allowed only three months for developing the presentation-feedback strategies, generating the detailed materials specifications, producing the materials, and trying out and revising the materials until they achieved a satisfactory prevalidation quality.

The present project staff alone was unable to carry out such a major undertaking, so it was decided that outside resources would have to be utilized. An assumption was made that only experienced college instructors in economics would have sufficient knowledge and judgment to be able to prepare learning materials that met the specifications that would be provided. It was decided (1) that such economist-writers should be sought to supplement similar economist-writers already on the project, (2) a materials specifications "kit" should be prepared for each part of the course and used by the economist-writers, and (3) a training program should be developed for all of the economist-writers, to train them in how to prepare materials to meet the specifications.

The decisions regarding presentation strategies were largely documented in the form of materials samples. However, certain explanatory materials and guidelines were also provided for the use of selected materials developers. The materials samples, explanatory materials, and guidelines were put together in a "kit" for the economist-writers. Kits were essentially alike; however, each kit also contained specifications for a unique portion of the course. Thus, each kit was "tailored" for the economist-writer in terms of the part or parts of the course he was preparing.

A kit contained the following items;[8]

1. Economics Course Outline
2. Behavioral objectives and sample test items for each segment for which the economist-writer was to prepare materials.
3. One or more materials samples, including an example of a completed self-instructional segment.
4. A list of the summarized behavioral objectives for the entire course. (This helped the economist understand how a given topic fit into the course structure. It was also helpful in preventing omissions and redundancies of material.)
5. A statement of guidelines for economist-writers. These were general guidelines for the self-instructional printed materials.
6. Instructional exercise answer patterns. Economists received copies of these so that they could provide for various self-testing and controlled testing exercises in their materials, using a student response board.
7. "Notes to Economists." These were the notes economist-writers received as an aid to them in developing materials. Many of these notes called for the development of subordinate behaviors in connection with learning to achieve a higher-level behavioral objective.

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[8] See Appendix C for samples of some of the items listed.

8. "Final Checklist: Economics Course Materials." The economist-writer was asked to use this checklist to make sure he followed the guidelines given to him.

Economics instructors from a number of universities were invited to participate as writers. A one-day orientation program was provided for those instructors who indicated an interest in participating. At this orientation, the philosophy of the course was discussed and materials development specifications reviewed. An outline of the entire course (see Appendix D) was given to each participant at the outset. This was supplemented by summary listing of all of the objectives (cognitive domain) of the course, broken down by topic and by segment within topic (see Appendix E). Thus, if an economist felt his forte was in a particular topic, he could quickly review the summarized objectives for that topic and decide if the topic had more than usual interest to him. (Normally, if an economist selected a topic, he prepared materials for all of the segments constituting it, but there were some exceptions in the case of some very large topics.)

The economist-writers left the orientation program with tentative writing assignments. A few decided that they did not want to participate after further reviewing the information they were given. Others immediately began their assignments.

Producing the Materials

About twenty economists from a number of universities participated in the materials specification and preparation process. Some worked on a full-time basis while others worked part time. The economics faculty and technology consultants were from the following universities:

American University
George Washington University
Harvard University
Nova University
The Catholic University of America
University of Maryland
University of Pittsburgh
University of Toronto

One of the functions of the economist-writer was to review the performance objectives and test items he received for accuracy and content validity. Materials released by the economist-writer were given the following treatment:

1. A behavioral check by a behavioral specialist using a checklist
2. Preliminary editing
3. A final instructional check by an economics professor with extensive recent experience teaching introductory economics

4. Final editing by a professional editor
5. Printing and duplication of packages for in-house preliminary tryouts

Part of the training given to the economist-writers was in the form of a critique of the manuscripts they submitted. Perhaps one-half of the economists who began to prepare materials for a topic withdrew on their own accord or were asked to withdraw. In nearly all of these cases, certain qualitative criteria were not being met by the materials developer. Typically, the person was a poor writer or he found writing to be a very laborious task.

The preliminary editing of the work received from the economists varied from a near rewrite to relatively minor changes. Good initial writing on the part of the economists could save substantial costs for the time and manpower required to revise it. The good, fast writers far outperformed their colleagues. In terms of expenditure per "unit" of material, one good writer might cost only one-third as much as an "average" writer and, in addition, meet due dates.

Preliminary Tryouts

The last step of the materials preparation task was to conduct the preliminary tryouts and to revise the materials based on the results. College students who generally resembled the students at the Naval Academy in respect to academic background and achievement were used for preliminary testing of the material. These students "took" course materials in the same sequence as the midshipmen were to take them, but one to two months prior to when they would be given to the midshipmen.

The main purpose of these tryouts was to discover ambiguities, information gaps, terminology problems, prerequisite inadequacies, or any other problem that may hinder achievement of the performance objectives. Materials that did not produce the desired learning were revised until they did. An interview technique was used in conjunction with item analysis and other techniques to identify where students encountered problems in the learning process. It was necessary to go through several tryout-revision cycles in some cases before an instructional segment was satisfactory. (Appendix F, an excerpt from a project technical report, describes the procedures used for the preliminary tryouts.)

The way in which learning packages were constructed made it possible to identify with great precision where a change had to be made in a segment to improve it. In the Self-Instructional Printed Packages, for example, an analysis of performance on the criterion test could indicate the segment, page within the segment, paragraph on the page, and sentence in the paragraph that caused the learning difficulty.

Comments on Parallel Development

The materials preparation process described above proved to be virtually trouble-free. Even though two semesters worth of mostly self-instructional course materials had to be produced in four months, this time span proved to be comfortable. Due dates were given to each writer that took into account the possibility that (a) he would meet the due date but his work would be of little if any value or (b) he would miss the due date by several weeks. Sufficient time was always reserved to either (a) reassign the work to an economist-writer who always produced acceptable work or (b) completely redo the material using core members of the project team.

While the materials were prepared in parallel, they were used in a linear sequence in the preliminary tryouts. In the MMCD Project, materials that needed to be ready soon for such tryouts always had the highest priority internally for needed edits, rewrites, reviews, typing, and duplicating.

CHAPTER IX

COURSE EVALUATION

It may be argued that informal evaluation defeats the purposes of evaluation because it yields data which are of dubious value for decision-making purposes. Hastings describes the purposes of evaluation as the collection of information--

1. To be used as feedback to innovators for further revision of materials and methods
2. To provide information as input for decision-making by the schools about the adoption of course-content improvement packages[1]

A definition of "evaluation" that resembles Hasting's description is offered by Alkin:

> Evaluation is the process of ascertaining the decision areas of concern, selecting appropriate information, and collecting and analyzing information in order to report summary data useful to decision-makers in selecting among alternatives.[2]

In reviewing the literature in curriculum evaluation, Baker points out that as a subject matter "it has not yet been defined and bounded."[3] He stresses the "considerable divergence" on many aspects of evaluation but points to an important area of agreement:

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[1] J. Thomas Hastings, "Curriculum Evaluation: The Why of the Outcomes," Journal of Educational Measurement, II, No. 1 (Spring, 1966), 27-28.

[2] Marvin C. Alkin, "Evaluation Theory Development," Evaluation Comment, II, No. 1 (1969), 2.

> Establishing an empirical basis for the revision and refinement of facilities, materials and methods appears to be a common objective of evaluation models.[4]

Stufflebeam proposed a CIPP (Context, Input, Process, Product) model for evaluation purposes, that helps to implement this type of approach.[5] Similarly, Provus described a "discrepancy model" that is directed toward decision-making, outlining five stages: (1) definition, (2) installation, (3) process, (4) product, and (5) cost-benefit analysis.[6]

Stufflebeam emphasizes that formal evaluations are typically poorly done, and he suggests a number of reasons why:

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[3] Robert L. Baker, "Curriculum Evaluation," Review of Educational Research, XXXIX, No. 3 (1969), 339.

[4] Ibid., p. 347.

[5] Daniel L. Stufflebeam, "The Use and Abuse of Evaluations in Title III and a Description of a Proposed CIPP (Context, Input, Process, Product) Model for Evaluation of Title III Projects." An address delivered at the National Seminar on Innovations sponsored by the Kettering Foundation and the U.S. Office of Education, Honolulu, Hawaii, July 1967.

[6] M. Provus, "Evaluation of Ongoing Programs in the Public School System," Educational Evaluation: New Roles, New Means, ed. by R. W. Tyler, Sixty-eighth Yearbook of the National Society for the Study of Education, Part II (Chicago: NSEE, 1969), pp. 242-283.

- educators dislike evaluation
- they are untrained in it
- it has not been done in the past
- good guidelines are lacking
- evaluation results have not been used[7]

In a comparable vein, Stake criticizes the way in which formal evaluations are being done, pointing out that they tend to be characterized by one or more of the following:

- checklists
- structured visitation by peers
- controlled comparisons
- standardized testing of students[8]

The evaluation task in the Multi-Media Curriculum Development Project was both planned and implemented within the framework recommended by the above researchers. In other words, an empirically-based decision-oriented process was employed. The evaluation task was a major undertaking, second only to establishing behavioral objectives in terms of manpower utilization. It was also the longest task, involving about a year and one-half to perform. While it presented problems, they were primarily a matter of reasonable professional disagreements which were resolvable in an acceptable manner and within an acceptable amount of time.

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[7] Stufflebeam, "The Use and Abuse of Evaluations in Title III and Description of Proposed CIPP Model for Evaluation of Title III Projects," p. 4.

[8] Robert E. Stake, "The Countenance of Educational Evaluation," Teachers College Record, LXVIII, No. 7 (1967), 1.

It should be mentioned that the results of the evaluation process had major implications for all aspects of project performance. A major function of evaluation was to determine whether or not the instructional process was producing learning that met established criterion performance levels. The instructional process was to be revised when a performance criterion was not met. See Figure 12 for an illustration of the evaluation concept employed.

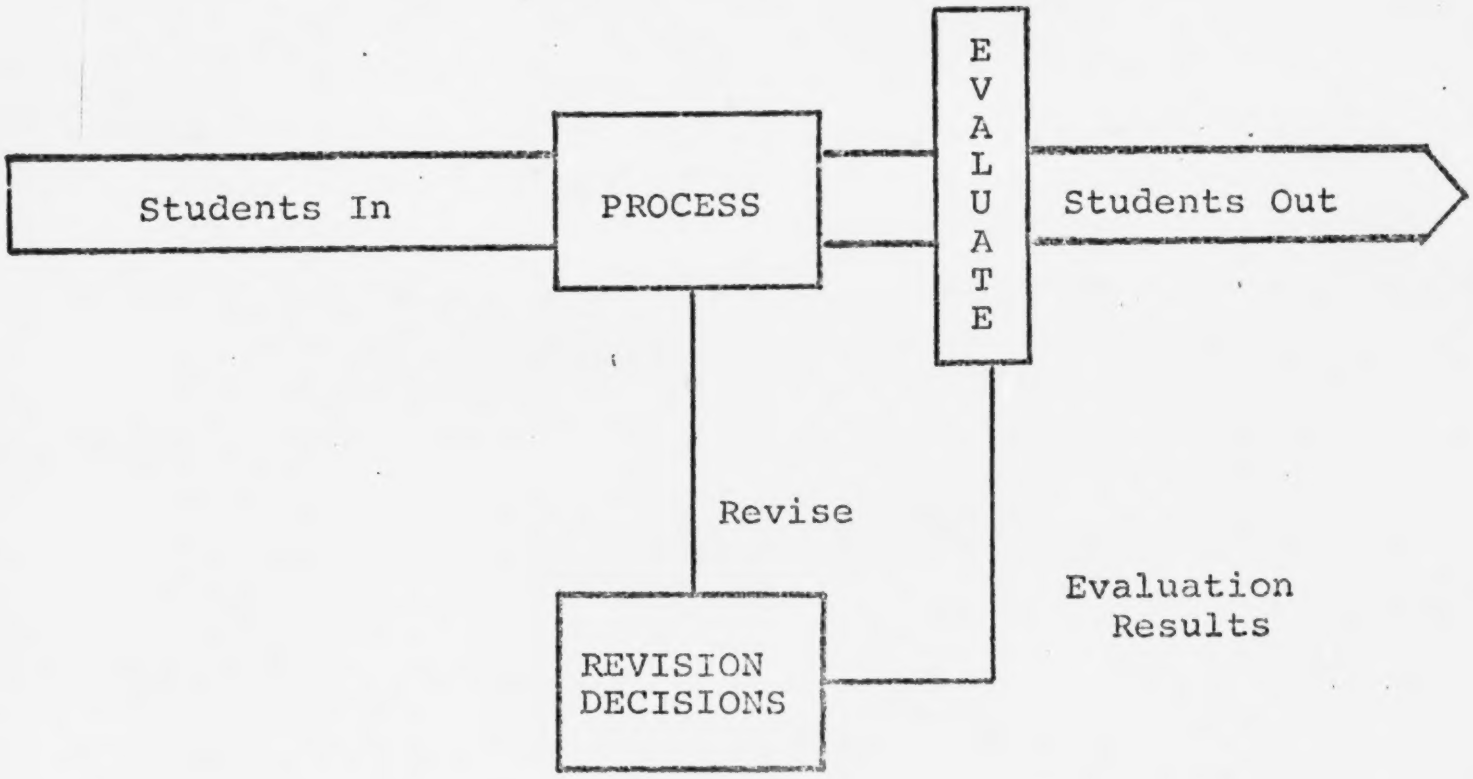
Students In
PROCESS
EVALUATE
Students Out
Revise
Evaluation Results
REVISION DECISIONS

Fig. 12.--Illustration of Evaluation Concept Employed

Two-Semester Process

The preliminary tryouts preceded the validation trial. Essentially the same tryout-revision process employed for the preliminary tryouts was used in the validation trial. This process is described in Appendix G ("Excerpt from TR-5.35: Preliminary Validation Report for Multi-Media Economics Course"). A brief explanation of how empirical data were used in deciding what revisions should be made is contained in Appendix H ("Excerpt from I.M. #87-R: Explanation of Materials Revision Process Based on Empirical Results").

It was believed that a course could not be "evaluated" until it was "validated." "Validation " was directed toward insuring that the instructional process produced the intended learning outcomes. The validation trial was a "complete system test," while the preliminary tryouts were in effect "subsystem tests." It does not necessarily follow that if each subsystem performs satisfactorily independent of the complete system that it will function satisfactorily as a system component. Thus, a function of the validation trial was to assess the extent to which the various components (segments, topics, pre- and post-tests, counseling, seminars, media, etc.) were integrated into an efficiently functioning whole.

Assuming that the integration is satisfactory, the various course segments should produce roughly the same achievement levels in the validation trial as they did in the preliminary tryouts. If criterion performance levels are not achieved in the validation trial, a decision must be made as to whether the rise in performance needed to meet criterion performance is worth the cost of revising the course, given the subjective probability that the course deficiency or deficiencies have been identified. Many variables, of course, affect student performance, and it is often difficult to ascertain with precision the reasons why student performance is below expectations.

"Evaluation," on the other hand, was directed toward the question of how well a validated instructional system operates within a given administrative-operational environment. It was thought that a "validated" course could be disseminated to other educational institutions, where it would probably be subjected to an "evaluation." A course could be validated but fail the evaluation at the institution for any number of reasons, such as incompatibility with administrative policies and procedures, significant differences in the comparable target populations, or different attitudes on the part of the faculty. Accordingly, the process of evaluation, as viewed in the MMCD Project, was aimed at determining how well a validated course "fits" at a given institution. If the fit is not satisfactory, a decision must be made regarding what changes might be made to produce a good fit and if the costs of making such changes are acceptable.

It was therefore concluded that there should be a "validation semester" and an "evaluation semester" for the new course. The validation semester, it was planned, would be highly controlled, in the sense that all course options would be tested, detailed responses would be captured, and great care would be exercised to ensure that if any students did not do well in the course it could be determined, within reasonable limits, if the instructional program were at fault. As in preliminary testing, it was always assumed that the instructional program was at fault if a student encountered learning difficulty, unless specific information indicated that there was some other cause. (Such information was sometimes obtained in interviews with students.)

A Methodological Issue

During the validation semester, students were not allowed to proceed through the course faster than a specified rate. This was done as a matter of simplifying course administration and minimizing administrative-operational problems while materials were being tested. As a result, pre- and post-testing and other events were scheduled for certain dates throughout the semester. A student could not take a test or participate in a special event prior to the first date for which it was scheduled. Thus, while there were major differences in time spent studying (see page 16 of Appendix I), no student could complete the course before another student.

In the evaluation semester, on the other hand, it was planned that the course would be presented in its "fully operational mode." And this was, in fact, accomplished. However, in connection with doing the planning for this semester, a problem arose with regard to the evaluation methodology. Consultants to the Naval Academy recommended a form of the classical experimental design, in which there would be a control group and an experimental group. A technical report from ETC argued the merits of using a CIPP-type evaluation approach, as indicated by this excerpt from it:

In the fully operational economic analysis course, as it is currently designed, students will be able to proceed through the course at their own pace, make many of their own decisions on media usage and optional enrichment areas, and otherwise exert a significant degree of control over when and how they study. In other words, the course is highly individualized in its intended operational state. It is very desirable that the course be evaluated in that highly individualized state.

A methodological problem can arise if one wishes to perform controlled media research during the "evaluation semester." An experimental design necessarily calls for extensive control of variables. And only when an experiment is carefully controlled are its results of value. The type of control generally required, however, is directly at odds with the concept of a highly individualized course. The very essence of a highly individualized course--the flexibility and options--presents the problem. It is possible to be faced with the alternative of either conducting a carefully controlled experiment or evaluating a highly individualized course of instruction.

In the present case, it is of critical importance that the evaluation apply to the course as it will be operating in the future. Any media studies conducted during the evaluation semester should disturb as little as possible the intended course operations. Only then will the results of the evaluation be useful. And of course, the results of media studies which do not disturb the normal operations will have greater value for a curriculum development model than studies conducted in a temporary artificial atmosphere.

One last point should be made regarding evaluation methodology. There is usually a "shakedown" period after a new system is first placed into full operation. During this period, it may become necessary to modify the system slightly to overcome an unexpected problem. The previous

> tryouts of the economics course have tended to validate its subsystems and its plan of operation. The shakedown period for the operational course will be the evaluation semester, which begins in September 1969. The evaluation methodology must be such as to permit necessary changes to be made in the administration of the course during this period.
>
> Evaluation activities may be described as falling into four basic categories:
>
> 1. Student performance
> 2. Student and instructor acceptance
> 3. Course management
> 4. General operational environment
>
> The ultimate measure of the success of a learning program is, of course, the performance of the students in achieving the learning objectives. However, the other three categories of activities listed above are important in facilitating or hampering the achievement of the desired performance. Each of the four categories is discussed below in terms of objectives, data required, method of data collection, and data analysis.[9]

The Academy and its consultants accepted and modified CIPP evaluation approach that was proposed.

Validation Trial

The validation trial was conducted over a semester's time, as planned. The following classes of data were collected:

- Learning time
- Learning-imbedded student responses
- Self-test student responses

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[9] Educational Technology Center, TR-5.37.

- Criterion post-test responses
- Medium-use record per student
- Student course critique information
- Instructor course critique information
- Critical incidents

These data were analyzed and used as the bases for course revisions. Appendix G ("Excerpt from TR-5.39: Final Validation Report") describes in detail the validation activities and the results.

As stated earlier, the validation trial assumed that the quality of the instructional segments had been confirmed through the preliminary tryout-revision process. In that process, some instructional segments went through as many as five empirically-based revisions, though this was infrequent (two or three were typical). It was important that the material be virtually "pre-validated" for use in the validation trial because only one empirically-based revision could result from that trial. This was the case because all of the subjects took the course at one time. A revision could not be "re-tested" in the validation semester because there were no more subjects available.[10]

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[10] New subjects could not be easily brought in, since it might take a new subject a month or more to acquire the entry behavior necessary to test a revised segment located in the middle of the course.

Since any revisions done following the validation trial could not be properly tested before the evaluation trial, extreme caution was exercised to prevent "over-revising." Over-revision was viewed as making changes in "problem" material beyond those clearly indicated by empirical data. If material were modified without a clear-cut empirical justification, it would be possible to make the material less effective than it was prior to this revision. Hence, tight controls were employed to review revision rationales before the material could leave the revision process.

Also, the standardization of the decision-making rules as pertain to revisions was considered a requirement. Decision-making guidelines were promulgated toward this end and review points in the revision process were established.[11]

Evaluation Semester

Evaluation activities fell into five areas:

1. Student Performance
2. Student and Instructor Acceptance
3. Course Management
4. Course Environment
5. Special Media Analyses

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[11] An example of a decision-making guideline may be found in Appendix H ("Excerpt from I.M. #87-R: Explanation of Materials Revision Process Based on Empirical Results"), where a step-by-step decision-making procedure is described.

Student Performance Evaluation

The primary purpose of this area of evaluation was to determine the efficiency of instruction. Efficiency was measured in terms of learning-time-taken and achievement scores on criterion-referenced examinations. Two classes of data were required:

1. Achievement scores on criterion referenced examinations, for each student on each control test
2. Amount of learning time taken by each student on each instructional segment.

The criterion-referenced control tests were administered to students by the course administrator, in an area provided for such testing. A student was permitted to take such a test as soon as he believed he could pass it. If he failed to achieve criterion performance in two tries, he was required to see his professor, who would make a diagnosis and prepare an individual learning prescription.[12] (This arrangement was intended to deter students from taking criterion tests more than once, without having studied, in the hopes they might pass some by chance. It was also intended to help identify, very early, the students who may have a serious learning problem which needed the diagnostic skills of the instructor.) The final achievement score obtained by a student on a control test was used as the measure of his "performance."

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[12] Based on experience, the probability of this happening was less than two per cent.

Time-taken was recorded on a segment-by-segment basis by each student. The student submitted his study time record to the Course Administrator at the time he took a control test. The total study time accumulated prior to the student's passing the control test constituted his learning time-taken for the level of achievement he obtained as indicated by his test score.

Student-Instructor Acceptance Evaluation

It was thought to be very important to take into account the attitudes and opinions of the students and the instructors involved in the multi-media course. Even if the course were effective from an instructional or learning standpoint, it was also important that the course be "acceptable" to those who are involved in it as instructors or students. There are different levels of acceptance, ranging upward from barely tolerable. The key level of acceptability, it was thought, was the level at which a student or instructor would be willing to continue with a course such as this in the next semester.

The purpose of this evaluation area was (a) to ascertain if students and/or instructors were willing to continue in a course designed as this one, and (b) to determine what aspects of the course might be changed to increase the acceptability while meeting the learning objectives.

Students' and instructors' comments on specific aspects of the course, as well as the course in general, were routinely solicited. The specific aspects of the course on which comments were solicited included each media-materials combinations and other planned instructional activities.

Critique sheets were issued with both instructor materials and student materials and were otherwise made available to the instructors and students. These sheets were sufficiently structured so that information was solicited regarding specific and general aspects of the course. However, the reply requested was "open-ended," so that no restrictions were placed on obtaining possible negative comments.

Critique sheets turned in for evaluation purposes were subjected to an analysis to determine (a) what aspects of the course were reported as best liked and (b) what aspects were negatively criticized. Absence of a negative response on an aspect of the course was taken to imply that that aspect was acceptable. The specific negative and positive comments served as the partial basis for revising the course administration to increase the general level of acceptability.

Course Management

The course management concerns instructor-student-media-materials logistics, schedules, learning prescriptions, and other aspects of providing for and monitoring instructional activities. Course management planning was done by a Course Administrator and the instructors within the context of previously established course management policies and procedures. A Course Administrator was responsible for administering the plan (he performed no instructional or formal guidance function).

The purpose of this evaluation area was to assess the adequacy of the course management plan and its administration and to ascertain what improvements might be made. Accordingly, information on problems that arose regarding course management was needed. This information, it was decided, should include a description of the problem, the date it first was detected, the circumstances under which it arose, what was done about it, who was involved, and what future action seemed advisable. The multi-media course instructors, the course administrator, and the liaison personnel of the contractor were each given a notebook and instructions for recording critical incidents. The data thus recorded are currently being analyzed to determine how undesired events might be avoided in the future.

General Operational Environment

A highly individualized instructional program cannot be designed without regard to the constraints that may be imposed by the general environment in which the program is to be carried out. Similarly, such a course cannot be successfully introduced into a conventional educational environment without the environment being changed to some extent. The "environment," as used here, refers to policies, procedures, staffing, facilities, and similar factors that constitute the situation within which the program, or course, operates.

Several examples may be given of the kinds of "conflicts" between the old and new often created by introducing such a course. A grading policy may have been established only after long and careful deliberation, but a question arises as to when "mid-term" grades should be submitted if a program is self-paced and students are at many different places in the course. Similarly, a media-materials resource center has a set of new requirements to meet when it must serve a highly individualized, multi-media course.

The purpose of this area of evaluation in the MMCD Project was to assess the effects of the course on its operational environment and the effects of the environment on the operation of the course. It was believed that such an assessment would provide information regarding what changes in the course or its environment might be advisable to further the learning goals.

Information regarding conflicts between the multi-media course and its operational environment had to be recorded. The recorded information was to include a description of the conflict, the date it was first detected, its implications, what was done about it, and what future action seemed advisable. The multi-media course instructors, the course administrator, and the contractor liaison personnel each were given a notebook and instructions for recording operational conflicts.

Staffing, Organization, and Costs

Some discussion of staffing, organization and general allocations of resources by phase may be of value at this point.

As would be expected, the project was staffed with professionals having a broad grasp of educational technology, plus experience with innovative educational projects. Figure 13 gives the organization chart for most of the project. Nearly every one of the sixteen persons indicated on the chart was involved in one or more advanced development projects prior to joining the MMCD Project.

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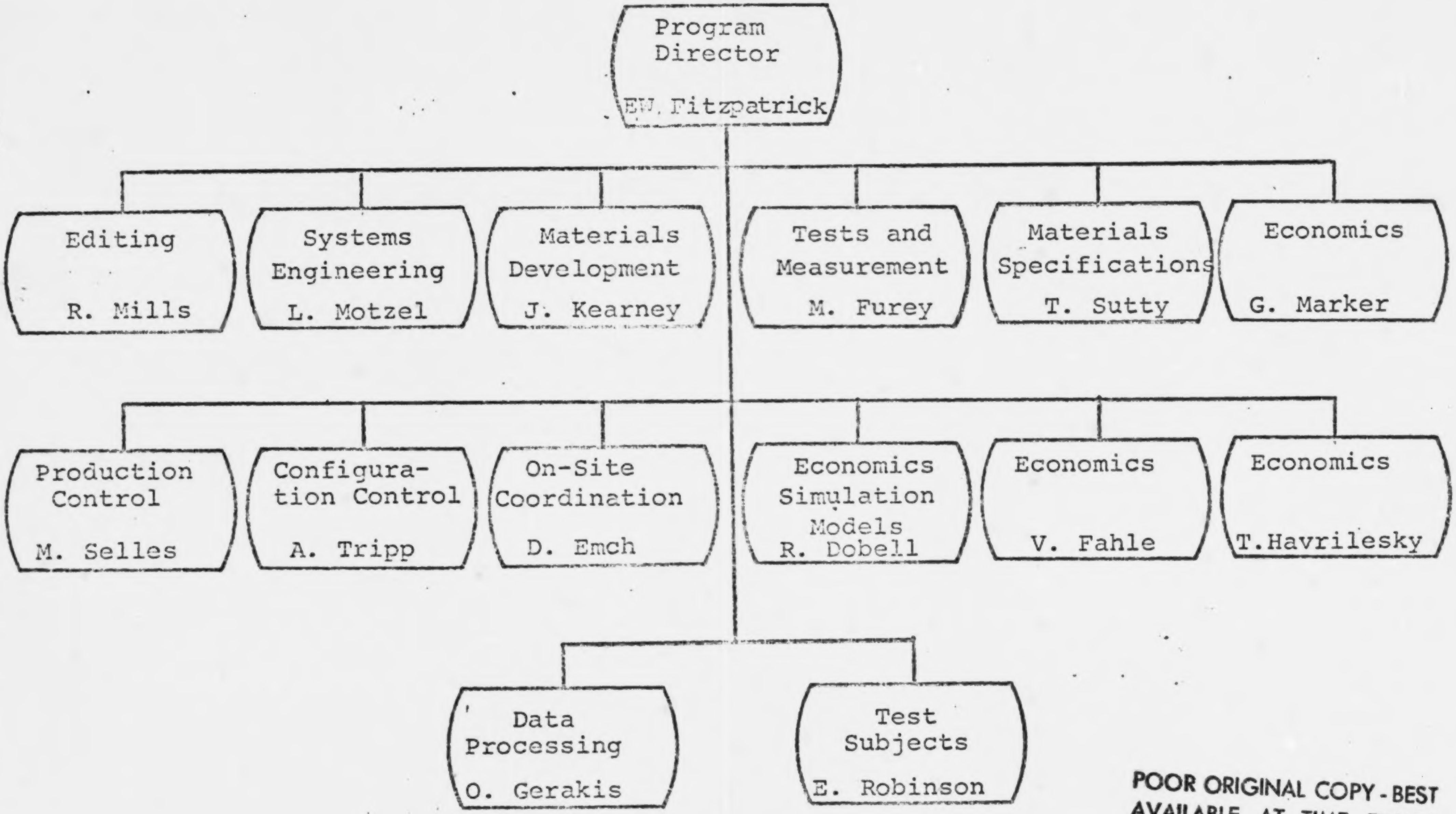
Program Director
EW. Fitzpatrick
Editing
R. Mills
Systems Engineering
L. Motzel
Materials Development
J. Kearney
Tests and Measurement
M. Furey
Materials Specifications
T. Sutty
Economics
G. Marker
Production Control
M. Selles
Configuration Control
A. Tripp
On-Site Coordination
D. Emch
Economics Simulation Models
R. Dobell
Economics
V. Fahle
Economics
T.Havrilesky
Data Processing
O. Gerakis
Test Subjects
E. Robinson

Fig. 13.--Project Organization

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Another characteristic of project personnel was that most of them were qualified to perform more than one function in the project. As a result, many of the staff took part in many tasks. Still another characteristic that deserves mention is that all but a few staff members had once been full-time teachers.

The costs of any curriculum development effort are dependent on many things. Costs must be measured in terms of resources expended. Based on the MMCD Project, the cost-ratios for the three phases of the project were about 2:2:1, respectively for phases I, II, and III. These cost ratios should be viewed as simply a frame of reference.

In an extremely complex educational problem area, the first phase might require a higher proportion of the total resources than the 40% indicated by the above ratios.

In an uncomplicated situation, the proportion required for the first phase might be less than 40 per cent. Similarly, the proportionate cost of Phase II can rise or fall based on the complexity and amount of the software that needs to be developed.

CHAPTER X

CONCLUSIONS AND RECOMMENDATIONS

It is appropriate that this report comment on the usefulness of the development model for other course developers.

Major Conclusion

The value of the development model that has been described in the previous chapters is suggested by the characteristics of the course that was produced using it. In other words, the course is the test of the model. A summary of the Final Evaluation Report is given in Appendix J. Note that among the students who completed the two-semester course in six weeks were (a) the student who spent the least amount of time studying and (b) the student who spent the most amount of time studying. This demonstrates the flexibility of the course in terms of the learning styles of individual students. In this connection, note also that ninety-eight percent of the students achieved eighty percent or more of the core objectives and nearly all of them achieved sufficient enrichment objectives to raise their grades one or more levels. Further, student and instructor acceptance of the course each semester it has been presented has been virtually unanimous and without reservation.

A course which can guarantee learning while earning the acceptance of students and instructors alike is of considerable importance. This course has the additional features, however, of (a) requiring one-third as many instructors as previously and (b) requiring one-third as much classroom usage as previously. Reductions in learning time, number of instructors required, and classroom usage can be translated into substantial cost savings.

Further, the entire course is replicable, and not dependent on non-transportable, high cost media, and its modular design and structuring options permit a user to tailor the course to his own circumstances. If necessary, the course could be presented in a completely self-instructional mode using only low-cost, battery-operated media that a child could carry. Thus, this validated course could be sent to places that have no economics instructors and no educational facilities.[1] These characteristics of the course can also be translated into substantial cost savings compared to conventional educational practices.

---

[1] In cases where there are qualified economics instructors available, the course should not be structured as completely self-instructional, but should use an instructor to conduct seminars, to work with students individually on special projects, to do counseling, and to perform a number of other valuable functions.

In view of the results, it must be concluded that the process by which the course was developed merits careful consideration by other course developers.

Usefulness of the Model

The model resulting from the MMCD Project provides a number of benefits to the educational community, but the model is not without its limitations. Some of the advantages of the model will be discussed first, followed by a discussion of certain apparent limitations.

Advantages of the Model

An important characteristic of the model is that it is not theoretical but empirically-derived. This gives the model much more authority than theoretical models, regardless of the elaborateness of their rationales.

Another important aspect of the model is that its starting point was the "state of the art" of educational technology. The project was planned using the leading or most promising theoretical approaches to various aspects of curriculum development and, in significant part, translated that theory to technology.[2] Thus, the model that was produced represents an advancement in educational technology.

A third advantage of the model is that it provides information about techniques which were successful individually and collectively. Some techniques may be successful in isolation but unsuccessful when used in conjunction with certain other techniques, rationales, or approaches. In the model that was produced, such aspects are integrated, and there is no question of compatibility.

A fourth advantage is that, in effect, the model suggests what not to do. The development model, as reported here, includes descriptions of approaches that did not work. While one should not conclude that an approach which failed in the MMCD Project will fail whenever and wherever it is tried in the future, it probably has a greater likelihood of failing than the approach found to be successful in the MMCD Project.

---

[2] What is a "leading" theory or a "most promising" approach is a matter of judgement. The Educational Technology Center judged that it used the leading or most promising theoretical approaches, based on a knowledge of the research in the field of educational technology, including the results of projects funded by the Office of Education's Bureau of Research.

Fifth, there is much flexibility "built into" the model. For example, it is possible for each of the three phases to be successfully conducted by an entirely different staff. And, indeed, this may be very important because different skill mixes are needed by project personnel in the major phases. Accordingly, one organization could produce the specifications for a new course (phase I), another organization could develop the instructional materials (phase II), a third organization could conduct the validation tryout (part 1 of phase III), and any number of organizations could then evaluate the course at their own institutions (part 2 of phase III).

A sixth point in favor of the model concerns the philosophy that underlies it--namely, the systems thinking. Systems thinking is an attitude, just as optimizing among alternatives is primarily an attitude. This kind of thinking can be applied by anyone concerned with planning and implementing education and training programs. The somewhat sophisticated modern management techniques that are part of the systems approach require special training or experience before one can hope to apply them successfully.

Finally, the development model is useful as a starting point for others, as a framework for further improving the model.

Limitations

The development model that emerged is by no means a panacea. While an important improvement over approaches that have preceded it, it is nonetheless capable of being significantly improved itself. Some of the more apparent limitations of the model are described below.

First, it is clear that the model requires highly skilled professionals--behavioral scientists, test and measurement specialists, media specialists, systems engineers, etc.--who are always in short supply. Also, it may well be the case that skill in using the model is as important as prior qualifications, perhaps including knowledge about the model. As a result, it would seem that training programs to teach the pertinent knowledges and skills required to use the model might be necessary before any extensive use of the model could result.

Second, the management of the curriculum development process was obviously an important element in the evolution of the model and the success of the Multi-Media Economic Analysis Course produced with it. The management approach used in the MMCD Project is not uncommon in leading industrial organizations. However, modern management techniques have by and large not been applied in our state and local educational systems. As a result, there are relatively few "modern managers" available who know enough about education and educational technology to conduct projects such as the

MMCD Project. A serious question is raised of whether or not such managerial expertise can be found in adequate supply in the educational community to manage major projects that apply a development model similar to the one reported here.

A third limitation is the amount of investment required to use the development model. There is no "minimum" cost to using it, but it seems clear that developing a course using this model is going to cost more than developing a course in the conventional fashion. It should be understood, however, that only the initial costs may be higher. If the model is used to produce a replicable course that guarantees learning and this course is compared with a conventional lecture course, the overall economic benefits of the replicable course that guarantees learning may far surpass those of a good lecture course. A replicable self-instructional course that guarantees learning could be used throughout the country. There is no way to replicate a live lecturer--he can only be in one place at a time.

The fourth limitation is that the model needs to be exercised under many different conditions, as a way of both further testing the model and strengthening it on the basis of empirical data.

Recommendations

Empirically-derived curriculum development techniques were in existence prior to the derivation of the curriculum development model reported here. However, a search of the literature yields valuable case histories, but no development model *per se*. Accordingly, the model reported here appears to have unique value because other empirically-derived models cannot be found. This reason alone recommends that the elements of the model, including techniques that worked and techniques that did not work, be considered by the person contemplating a curriculum development project.

In view of the success of the Multi-Media Economic Analysis Course produced using the model, it is reasonable to recommend that the model be used in further curriculum development activities. This could have several advantages. First, it could produce courses that guarantee learning, which is a characteristic that few courses have. And such courses could be acceptable to the students, teachers, and administrators involved with them. In addition, further use of the model could help to "test" the model in more varied situations. This would include different subject matter, different student populations, different resources and constraints, etc. The model itself could be revised based on such tryouts, so that it continues to be improved for future application.

The model also could benefit from continuously incorporating and translating to practice the results of new research on learning. For example, the ability to more effectively individualize instruction can be enhanced through further research on learning styles. Further research on creativity or in the broad area of the affective domain could also benefit the model and thereby help to produce better curricula.

If the model were improved through contributions from applications of the model in diverse situations and from learning research, its utility would be similarly improved. Presumably, it would provide, as a guide, many alternative strategies at the key decision points, plus the criteria to help the curriculum planner select the alternative that is most appropriate to the requirements of his situation. This could immensely strengthen the model as a decision-making aid.

However, with improvements, the model would become much more complex than it currently is. It is therefore recommended that the model be converted to the form of a computer-based simulation. This would permit curriculum planners to "test" the probable effects of alternative decisions regarding their planned curricula. Having the development model in the form of a computer-based simulation would facilitate the use of the model (since the computer can simultaneously manipulate many variables) but also quickly facilitate modifying the model to incorporate new information.

APPENDIX A

Description of Components of the Course

COURSE MATERIALS

MULTI-MEDIA ECONOMIC ANALYSIS COURSE

The Multi-Media Economic Analysis Course developed by the Educational Technology Center of Sterling Institute consists of the following material:

- Seven (7) volumes of self-instructional texts
- Three (3) self-instructional audio-workbook packages
- Eleven (11) computer-based simulation models
- Nine (9) 16mm films
- Criterion-referenced pretests and post-tests for use with the above instructional material
- Instructor's Guide, Course Administrator's Guide, Student Handbooks

Self-Instructional Texts

The contents of the seven volumes of self-instructional texts are listed below. The approximate student study time required to master the material in each volume (i.e., to successfully pass the associated criterion tests) is also given. Note that the last of the seven volumes is called "Enrichment."

Volume	Approx. Study Time (hours)	Content
I	8-11	Nature and Methods of Economics Production Possibilities Demand, Supply, Equilibrium The Circular Flow
II	10-16	The National Income Accounts The Theory of Income Determination: Part I The Theory of Income Determination: Part II The Role of Fiscal Policy in Income Determination
III	8-11	The Role of Money & Banking in the Economy: I The Role of Money & Banking in the Economy: I The Role of Money & Banking in the Economy:II
IV	7-12	The Theory of Demand (Value) Costs of Production & Supply: The Short Run Costs of Production & Supply: The Long Run Industry Equilibrium in a Perfectly Competitive Market

Volume	Approx. Study Time (hours)	Content
V	9-13	Monopoly Markets Monopolistic Competition Oligopoly Markets The Theory of Factor Demand and Supply
VI	8-12	Specialization and Trade International Trade
Enrichment	7-9	A Spectrum of Economic Systems The Influence of Government and Foreign Trade on National Income The Product and Monetary Markets

Self-Instructional Audio-Workbook Packages

The Self-Instructional Audio-Workbook Packages serve as an alternate media-mix for parts of the first three volumes of Self-Instructional Texts. Each package contains both a workbook and one or more cassette-type audio tapes. The contents of the packages, and the approximate student study time, are:

Audio-Workbook	Approx. Study Time (hours)	Content
A	1½	Demand, Supply, Equilibrium
B	2½	The Theory of Income Determination: I
C	3	The Role of Money & Banking in the Economy: III

Computer-Based Simulation Models

Eleven economic simulation models were tailored for use on a commercial time-shared computer system. The eleven simulations, all in macro economics, are listed below. The simulations may be used by the individual student or by groups of students (e.g., a demonstration before a group). A minimum of 35 minutes is recommended for exercising a simulation model.

- The Investment Multiplier
- A Model With Induced Investment
- Fiscal and Monetary Policy
- Government Tax and Expenditure Policies
- The Demand Model With a Money Market
- Demand Model With a Foreign Sector
- The Complete Demand Model
- Full Employment Output
- Capacity Output and the Production Function
- Effective Demand and Potential Supply
- Aggregate Demand and Potential Money Supply

Motion Pictures

Nine films were rented for use during the course. These films were selected because of their compatibility with course objectives. It is planned that other audio-visual materials may be specially developed for use in the course, perhaps supplanting one or more of these films. Each film is about 30 minutes in length. The titles of the films, all of which were from the Coleman series The American Economy, are:

- Introducing the Price System
- Gross National Product & Its Cousins: Part I
- Gross National Product & Its Cousins: Part II
- How Money Expands and Contracts
- Banks for Bankers: The Federal Reserve System
- Money and the "Fed": Part I
- The Case of One Firm
- The Case of Few Firms: Part I
- The Case of Few Firms: Part II

Criterion-Referenced Tests

Criterion-referenced pretests and post-tests are provided for all of the material mentioned above.

Instructor's Guide, Course Administrator's Guide, Student Handbook

These guides and handbook describe how the course is operated and what options exist for the student, the instructor, and the course administrator. These materials tell how the course may be operated in the fully self-paced mode.

Use Options

The course may be operated with only Self-Instructional texts. The "minimum" course should include Vol. I (Basic Concepts) and Vol. II (Macro Economics) or Vol. I and Vol. III (Micro Economics). Volumes I through VI, plus the Enrichment volume, constitute a very substantial course for one semester (and, in terms of weight, about 10-12 pounds of text). The Self-Instructional Audio Packages are, as mentioned earlier, alternate media to some of the self-instructional material appearing in Volumes I through III.

If one adds the simulations, the 16mm films (or their substitutes), and includes the recommended seminars and group discussions, the demands on the student's time similarly increase. The simulations, however, may challange the most advanced student in the course. Films are becoming available that will show economic processes while they are happening in real life, an important aspect of communicating relevance. And the seminars represent critical opportunities to integrate and synthesize learning, to generalize to other situations, and employ group dynamics to otherwise stimulate the students.

APPENDIX B

Comments on Media Applications

Self-Instructional Printed Packages with Student Response Boards

These packages combine large-step, linear programming and adjunctive programming. Specially-developed models served as guidelines for applying this hybrid programming style in developing materials for particular objectives.

Great care was given to taking the student from the known to the unknown, in providing him with ample examples and illustrations, and in giving him sufficient practice of the desired performance. Learning-imbedded tests are used "in the learning" and at the end of each package there is a diagnostic self-test.

The Self-Instructional Printed Packages are used with a portable student response board, which can be used in the dormitory room, the library, the classroom--wherever the student studies best. Nearly all test items included in a package, including the learning-imbedded items and the diagnostic self-test items, are programmed for the board. The student responds to multiple choice items by selecting and depressing one of four response keys. If he selects the correct answer, the indicator advances to the next test item number. This "advance" informs the student that his answer was correct. If he selects a wrong answer, the key remains depressed and the indicator does not advance. The indicator does not advance until the correct answer is selected. In this way, the student is always given immediate feedback on his response, whether incorrect or correct.

The response board has 15 different answer pattern settings, including a special setting for "control" tests--that is, tests used for grading purposes. On the control test setting, the unit advances each time a key is pressed and the student gets no feedback during the test. An important feature of the student response board is that a computer processable punched card can be produced each time a test is taken. Such records are useful for validating learning materials as well as recording a student's relative progress.

In summary, the Self-Instructional Printed Package with Student Response Board was selected as the primary instructional medium in the course because its characteristics best matched the micro and macro-media selection criteria.

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Self-Instructional Audio Packages

A Self-Instructional Audio Package consists of cassette audio tape, a workbook, and a portable tape recorder. The student response board is used for the practice problems and self-tests. These packages employ the same hybrid programming style as the Self-Instructional Printed Packages, but with certain added features. These packages were programmed following audio-practice-audio-practice cycles. The idea was to deliver the audio in a crisp fashion, using a "large step size," unimpeded audio flow. No audio is given during intervening practice and problem-solving periods.

The Self-Instructional Audio Packages were selected for learning situations requiring explanations of complex graphs, where the audio can be used to draw attention to and explain elements and relationships portrayed by such graphs. It was also assumed that some students would prefer audio-oriented instruction or be able to learn from it easier than from visually-oriented instruction.

Computer Simulations

An Economics Simulation Model consists of a computer program which the student can exercise at a computer terminal, a workbook which contains information about the model, and a cassette audio tape which explains in detail its workings and its relationship to other parts of the course. There are approximately twelve such models.

The rationale for using simulation was to provide for cognitive structures that transcend, integrate, unify, and reinforce the learning of groups of related instructional topics and course segments. They are easily able to provide highly complex problem-solving activities dealing with variables from many different parts of the course.

16mm Film

These black and white films are approximately one-half hour in length each and were selected from Coleman's "The American Economy" series. While motion pictures represent an extremely high-cost medium if original films are produced, the opportunity to rent or purchase applicable films renders this medium feasible for possible use on a relatively extensive basis. Films were selected that generally teach the same student performance called for in some segments of the course. The films represent a different programming approach.

Seminars

There are simulation seminars, remedial seminars, and general or enrichment seminars. The role of the instructor is to serve as a seminar leader. A seminar may involve from 2 or 3 students to 15 or 20 students. Seminars were selected for a number of reasons, such as to provide a means for sharing insights and experiences, to enhance group identification, and therefore to increase or maintain student interest and motivation.

Counseling

Counseling is done by the instructor, usually (not always) in a one-to-one student-instructor relationship, and preferably with some degree of privacy. Counseling sessions are viewed as critical opportunities for the instructor to motivate students and to relate activities to their interests and goals. Counseling was selected as the only currently available means of diagnosing the more difficult learning problems and determining the enrichment learning needs of the very advanced student.

Lecture-Discussion

In the lecture-discussion situation, the instructor first presents information, using audio-visual aids as appropriate. A brief group discussion follows each key point presented. The lecture-discussion was selected primarily as a means of enabling the instructor to stimulate, motivate, or otherwise cause enthusiasm over the course. A secondary reason for selection was to inform students of what is to be expected in the course.

Tutor

In tutoring, the instructor, or an advanced student selected by the instructor, meets individually with a student having learning difficulties. The individual tutoring is aimed at well defined trouble spots uncovered by tests. This is a very costly medium selected only for use in last-resort remedial situations, after a student has unsuccessfully used other remedial media.

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Related Texts

The two best known introductory economics texts are used as "related texts." The instructor is free to designate other materials as similarly "related." Related texts were selected as readily available media for remedial purposes or enrichment purposes, depending on the specific learning prescription.

Computer-Based Test Analysis

All pretests and post tests for core and remedial segments are automatically recorded on computer-processable punched cards, as a result of the use of the student response-feedback boards. These cards are pre-punched with each student's identification number.

This approach was selected as an efficient means of obtaining student performance data that can be manipulated by a computer for analytical and record-keeping purposes. It allows the student to take a test at virtually any time, without an instructor being present. It also avoids problems of (1) tying up expensive equipment during student "think" times, (2) creating student queues at computer terminals, and (3) general problems of logistics so often encountered in testing.

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APPENDIX C

Sample of Items from Kit for Materials Preparers

The sample includes the following:

#1. Materials Preparation Course Outline

This is the outline of the course given to the materials developers.

#2. Final Check List: Economics Course Materials

The economist-writer used this checklist to make sure he had followed the guidelines given to him.

#3. Guidelines for Economist-Writers

These were general guidelines for use in developing the S-I packages. Note that the type of learning for each objective is indicated in this document.

#4. Notes to Economists

These are examples of the types of notes economist-writers received as an aid to them in developing materials. Many of these notes call for the development of subordinate behaviors for a behavioral objective.

#5. Example of Detailed Behavioral Objectives, Test Items, and Hierarchy Charts in the Form They Are Given to Materials Developers.

This example concerns the topic "Specialization," which consists of two segments (segments-# 6 and # 7). An attempt was always made to assign all of the segments in a given topic to the same materials developer.

#1

MATERIALS PREPARATION

Course Outline

I Introduction

A. Purpose of Course

To prepare you to prepare learner-centered instructional materials in accordance with a format specified for this project.

B. Scope of Course

1. The nature, scope, objectives and status of the project.
2. The technical concept of individualized instruction.
3. Operational concept for individualized instruction.
4. The model learning package; the design of the model learning package; the rationale.
5. Given "inputs," prepare "outputs," review and analyze.

II The Nature, Scope, Objectives & Status of the Project

A. ESOE/NA - Multi Media Course Development

1. Model Development (OE)
2. Fixed Price/Schedule
3. Product Econ. Course (NA)
4. Behaviorally Oriented - Briggs/Gagné model
5. Status
   a) completed (show materials and hierarchy)
   b) yet to do
      - Phase II
      - Phase III

III Technical Concept

A. Behavioral Hierarchy
B. Individualized Instruction
C. Validated Materials
D. Gagné's Model
E. Pitfalls and Misconceptions

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IV Operational Concept

A. Remedial, Core, Enrichment
B. Dymedia
C. Multi-media

V Format for Materials

A. Cover Page
- Responsibility: Sterling/Tripp
- Contents: See Illustration A

B. Table of Contents
- Responsibility: Sterling/Tripp
- Contents: See Illustration B

C. General Instructions
- Responsibility: Sterling/Tripp
- Contents: Prerequisite Segments
  Dymedia Settings
  Package/Topic information
  Use of Segment/Dymedia, etc.
  (boilerplate mechanics)

D. Introduction to Topic
- Responsibility: Economists
- Contents: Brief Narrative (2-3 double spaced pages) stating in very direct terms
  (1) the overall terminal objective of the topic
  (2) the significance of this topic; why it is important, how it relates to other topics, etc.
  (3) how the topic presentation is organized, what the student will learn first (Segment x), what he will learn next (Segment x +1), etc.
  (4) pitfalls and/or difficulties (false friends!) which the student can expect to encounter.

Note: The purpose of this topic introductory statement is to
(1) motivate the learner
(2) provide the learner with an "organizational framework" and/or a perspective for learning. Tell him what he is expected to learn and why; alert him to problems of semantics, etc.

E. Segment Cover Page
- Responsibility: Sterling/Tripp
- Contents: See Illustration C

F. Introductory Statement
  - Responsibility: Economist
  - Contents: A brief introductory statement to the segment -- same as topic introduction but at the Segment level. Remember that the student may have read the topic introduction on a different day or study session; the segment introduction may therefore repeat some of the idea in the topic introduction.

G. Objectives and Instructional Events
  - Responsibility: Economist

First Objective (bottom of hierarchy)
  (1) Question format
  (2) Narrative
    - recall
    - explain terms, etc.
    - present facts
    - give examples/illustrations
  (3) Practice Problems
  (4) References to texts

Note:
  (1) "Recall
    a. only what has been previously learned (reference the segment or objective)
    b. may use "economics terms" which have been previously learned; distinguish from previous usages
    c. all sub-concepts should be "recalled."

  (2) "Explain terms"
    a. no economic terms -- build bridge from everyday English to economic concept; no "economese."
    b. explain what things are, what they are not; what they include and what they exclude; give definition or description or illustration of all key phrases in "performance" part of objective.

  (3) "Present facts" - or answer to question in clear simple English

  (4) "Examples and illustrations"
    a. give "for instances," work through typical problems explaining steps
    b. induce transfer by giving several examples from different perspective
    c. examples should be clear, concise and relevant
    d. interrelate with previous material.

(5) "Practice"
  a. Give 3-5 practice problems and/or questions; "force" student involvement and participation
  b. Induce transfer by giving problems with different backgrounds, etc.
  c. Immediate knowledge of results through Dymedia; number sequentially throughout segment.
  d. Motivate and interest students (the behavioral objective simply states the activity on the part of the learner which will be accepted as evidence of his having achieved the desired learning; it is the instructional events, and in particular the "practice," which must ensure that the student really understands what he is doing when he makes the required response.)

(6) "Reference to texts"
  Give references to standard text book discussions of the subject; at least to McConnell, Samuelson.

H. Self Test and Prescription
  . Responsibility: Sterling/Furey - Economists
  . Contents: Segment tests to be provided; economists review for content validity and recommend changes.
  . Prescriptions: economists recommend "remedial study" for test items (or groups of test items) missed.

I. Topical Hierarchy
  . Responsibility: Sterling/Tripp

J. Topic Summary
  . Responsibility: Economist
  . Contents: one or two page narrative review of all segments and objectives in the topic; overview; weave the pieces back together.

VI Inputs to Economists

A. Course Segmentation Syllabus and behavioral objectives for other segments (as required). The economist is responsible for ensuring that prerequisite material has either been covered in previous segments or is presented in the segment which he is preparing.

B. Segment Topic Introductions

Preliminary versions will be provided; Economist should read the introduction of all related segments, resolve outstanding questions he may have, and revise the introduction to the topics and/or segments which he is preparing, as appropriate.

D. Behavioral Objectives and hierarchy -

Review, any change must have prior OK of Fitzpatrick; use "change procedure."

E. Criterion Test Items

1. For reference only (i.e., not to be used for practice or example problems)
2. Economist should review for content validity and revise as necessary; revisions of test items require approval of M. Furey -- submit with recommended changes.

F. Segment Test

Preliminary test is provided; economist should review for content validity, etc.; changes require approval of M. Furey -- submit with recommended changes.

VII Concept Summary

A. Input

1. Preliminary introductions
2. Notes to Economists
3. Prelim. segment test
4. B.O.'s and Hierarchy
5. Criterion test items

Auxilliary

6. Segmentation syllabus
7. Model of output
8. Other segment BO's as requested

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B. Output (deliverable item)

  1. Final version of introductions
  2. Recommended changes in BO's and/or hierarchies
  3. Recommended changes to criterion test items
  4. Instructional events for each objective
  5. Topic summary
  6. Discussion references and prescriptions

VIII Operating Procedure

  A. Assign topic to economist
  B. Review intros, objectives and hierarchy
  C. Write Topic Intro
  D. Write Segment Intros

  F. Recommend BO changes

  G. Write Instructional Events
  H. Review test items and recommend:
    1. Segment tests and Prescription
    2. Criterion items review
  I. Write Summaries
  J. Review and format total package
  K. Final review by in-house economists

XI Discussion of milestones, etc., importance of meeting commitments.

XII Role and Responsibilities of Personnel

  A. Fitzpatrick
  B. Furey
  C. Tripp

XIII Miscellaneous

  A. Creativity
    . Ideas
    . In the Example/Practice
  B. No Royalties
    Public Domain
  C. Copyright Problem

Illustration A

INTRODUCTION TO SPECIALIZATION

Learning Segments 6/7

Introduction to Economic Analysis

Prepared for the
United States Naval Academy
by
Sterling Institute of
Washington, D.C.

SPECIALIZATION

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0506 Identify Producer with Comparative Advantage
0500 Identify Types of Advantages and Basis for advantages in various situations

Self Test and Prescriptions 2.__

Segment Y Cover Page

Introductory Statement 3.0

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0510 Definition of Opportunity Cost
0505 Basis for Specialization and Trade
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SEGMENT 6

INTRODUCTION TO SPECIALIZATION

(Part 1 of 2)

Dymedia Settings:

Learning - E

Self Test - L

FINAL CHECK LIST

Economics Course Materials

Introduction to Topic

_____ A general statement of topic?

_____ Relation to other topics?

_____ What student will be able to do when he completes topic?

_____ Sequence and/or organization of materials to be presented?

_____ Possible difficulties?

Introduction to Each Segment

_____ Transition from topic introduction?

Segment Objectives in General

_____ Every objective directly addressed?

Individual Objectives

_____ Prerequisite concepts recalled and restated, if covered earlier?

_____ Prerequisite concepts explained in everyday terms, if not covered earlier?

_____ No new technical terms used without explanation?

_____ Examples in sufficient quantity (usually two or more) and diverse enough to stimulate generalization?

_____ Practice problems in sufficient quantity (usually three or more) and drawn from diverse backgrounds?

_____ Practice problems numbered sequentially throughout the segment, with first problem in each segment numbered "1"?

_____ Answer choices in practice problems so lettered as to fit Dymedia Answer pattern?

_____ References to Samuelson and/or McConnell for each objective?

_____ All test items reviewed and approved or changed?

Topic Summary

_____ Checked against topic introduction?

#3

Guidelines for Economist Writers

A. General Instructions

1. Materials should be written in a clear, narrative style, in complete sentences in good English.

2. Writers should avoid the use of "economic jargon" which could confuse students in introductory economics courses. The materials, with only a few editorial revisions, will be given to the students just as the writers have prepared them; therefore, it is imperative that the content is correct and readily understandable.

3. Handwritten manuscripts are acceptable, providing the writing is legible and on only every other line. Typewritten manuscripts should be double spaced.

4. Writers must include all of the objectives provided them in the materials. If the writer is convinced that additional information must be included in order to clarify or enhance the prescribed objectives, then he should include such information. Additions are desirable and expected as has been indicated in the "Notes to Economists." Should the writer decide that a change in the wording of an objective is imperative and that the new language is not equivalent to that in the original version, then he should contact Mr. Fitzpatrick (338-8800, Ext. 37) concerning the proposed change prior to incorporating it in the materials.

5. Test items A, B, C must not be used as illustrations and practice problems as they have already been used in segment and unit tests, pretests and post tests.

   After the materials have been written, please indicate by writing "yes" or "no" on each A, B, or C test item whether the item tests the objective to which it is keyed. If the writer feels that a distractor is incorrect or that the item can be improved in any way, he should write all suggestions, including new distractors, etc., below the item.

6. In writing about eighty percent of the materials, writers should follow steps 1 through 12 below. The other twenty percent will require a deviation in the steps as indicated in steps 13 through 17 or in steps 18 through 21. Objectives requiring a change will be indicated in the segment kit.

   Special attention should be given to providing a rich supply of examples (real-world, relevant) illustrative of

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the principles or concepts to which the objectives of a given topic are addressed. If copyright material is used, then permission should be obtained and the appropriate references given.

7. Be sure to complete the check list and return it with the manuscript and the original contents of the kit to Sterling Institute.

B. Steps in the Preparation of Materials

1. Check the kit you receive to see that it contains:

   a. Cover page
   b. Table of contents
   c. General instructions
   d. Preliminary introduction to the topic and/or to the segment
   e. Hierarchy chart for each segment in the topic
   f. Three test items (A, B, C) for each objective in each segment
   g. Segment test for each segment
   h. Notes to Economists
   i. A list of objectives requiring Sample B or C

2. Read the preliminary introduction, all objectives and test items for the topic. This will provide a general overview of the learnings the student must master and the type of question he will be expected to answer when tested.

3. Read the "Notes to Economists." These notes are not all inclusive but point out learnings which should be reviewed or recalled, or additional information which should be included to facilitate the learning of the objective. It is recommended that the writer star or in some way mark each objective for which there is a note, as a reminder to consider these suggestions when writing.

4. Begin the narrative with an introductory statement of a few sentences which relate the segment to the topic and lead in to the first objective (See Sample A, p.). The writer may prefer to write an introduction to the topic prior to writing the introduction to the segment; however, it seems preferable to write the topic introduction after the materials have been completed to avoid the necessity of revisions.

5. Introduce the first objective (abbreviated title). This may be in the form of a question or of a title. Place the number of the objectives to the left of whatever means is used. (See Sample A, p. .)

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6. Continue narrative. If it has been indicated that the objective should be handled according to Sample B, then follow steps 13 through 17. If Sample C has been indicated, follow steps 18 through 21 . Otherwise, continue by recalling information previously learned or by explaining new terms. The "Notes to Economists" should be of assistance at this point. (See Sample A, p. .)

7. Present at least two examples or illustrations to clarify the principle to be learned. In some instances, where the objective is complex, as many as four, five or six examples may be necessary to illustrate all points. The examples should be relevant and interesting to college students. If the writer has any unique devices or methods which he has found effective in teaching a particular objective, he should feel free to include these.

8. State the definition, principle, etc., at an appropriate point, and enclose the statement in a box. Be sure that the language used is the same as or equivalent to that used in the objective. (See Sample A, p. .)

9. Present two or more problems which require the application of the principle. The number of problems will vary with the complexity of the principle, a complex principle requiring a wide variety of applications.

10. Provide answers in the narrative to those problems which require the student to fill in blanks or place a check in front of an answer. Answers should immediately follow the problem. (See Sample A, p. .)

    Other problems should be keyed to a Dymedia setting. (See Sample A, p. .)

11. Provide a reference for additional information. (See Sample A, p. .)

12. Continue narrative with a lead in to the next objective. If the objective should be handled according to Sample B, follow steps 13 through 17; if according to Sample C, follow steps 18 through 21. If no particular plan is recommended, repeat steps 5 through 12 until all the objectives have been accounted for.

13. Begin the narrative with examples of the concept to be learned. Then, link the examples to the concept. (See Sample B. p. .)

14. Underline or enclose in a box the concept to be learned.

15. Provide at least two problems or items which appraise the student's knowledge of the concept.

16. Supply answers to the above-mentioned items immediately following them (preferably buried in the narrative).

17. Indicate a reference to which the student may go for additional information.

18. Give at least four (number will depend on the complexity of the subject) examples some of which do and some of which do not belong to the classification.

19. Indicate in the narrative which examples correctly or incorrectly illustrate the concept and why.

20. Provide additional practice (at least 6 to 10 items) in discriminating among appropriate and inappropriate examples of the concept. Again, the number of examples will depend on the complexity of the concept.

21. Provide a reference to additional information which may help the student who experiences difficulty.

22. Following the last objective in the segment, instruct the student to take the self-test and to follow the prescription for any re-learning which may be necessary. (See Sample A, p. .)

23. Review the objectives, test items, hierarchy chart, Notes to Economists, etc., for the next segment.

24. Write a short introduction to the segment, relating it to the previous segment and to the topic. (See Sample A, p. .).

25. Continue in the manner outlined in steps 5 through 22 above.

26. When the last segment has been completed, write a general introduction to the topic including an overview of the terminal behaviors, the significance of the material, the relationship of this topic to other parts of the course, and mention of any difficulties which might be encountered in learning the objectives. (See Sample A, p. .)

27. Write a brief summary of the topic, including the main points of all the segments.

28. Complete the check list and return it, the kit, and your manuscript to ETC.

The narrative in Samples B and C differs from that used in Sample A in that the former begins with examples or illustrations of what is to be learned, whereas the latter asks the student to recall knowledge previously learned but pertinent to the new learning. In Sample B the student is learning three concepts; in Sample C he is making multiple discriminations among examples of a concept.

Sample B

Obj. #0896 What are the three types of related goods?

There are many ways in which goods are related; e.g., ham, bacon, and pork are related because all originally were part of a pig. In economics, there are different types of relationships. Eggs, cereal and waffles are three foods consumed by many people for breakfast. If the price of eggs increased, the demand for cereal and waffles would probably increase as these commodities were substituted for eggs for breakfast. There is an economic relationship among eggs, cereal and waffles. One can be a substitute for the other, so all three are known as substitute goods.

Let's consider the commodities, autos, tires and gasoline. Tires and gasoline cannot be substituted for autos, but all three commodities are related, economically speaking, for they complement each other. Hence, these goods are known as complementary goods.

The products, milk, bricks, and roses are not related economically; hence, they are called independent goods.

In economics, the three types of related goods are substitute goods, complementary goods, and independent (unrelated) goods.

Can you name the three types of related goods? Fill in the blanks in the following sentence with the names of the types of related goods. Don't look back.

In economics, the three types of related goods are __________ goods, _____________ goods, and _____________ (or unrelated) goods.

Check your answers with those given in the box above.

If you need further instruction in this work, read McConnell, p. 65.

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Sample C

Obj. #0295 Identify examples of problems for micro-economics analysis

You have learned the definition of micro-economics. Can you identify specific problems which would be categorized under micro-economics? Read the following economic problems.

a. A wildcat strike at the U.S. Steel Company plant in Pittsburgh
b. The President's annual economic report to Congress

Is the first example a problem for micro-economics analysis? If you think that it is, you are right because the U.S. Steel Company is an individual firm, and micro-economics analysis is concerned with problems related to individual firms. Examble "b" is concerned with the nation as a whole and would not be a problem for micro-economics analysis.

Look at some other examples. Check each problem for which micro-economics would be appropriate. As you make your decision, justify it (to yourself).

___ c. The U.S. Chamber of Commerce suggesting ways to stimulate employment
___ d. A homeowner negotiating a loan agreement with his local bank

Did you check only "d"? The example given in "c" is concerned with the nation's unemployment, not that of an individual firm; whereas, "d" is concerned with an individual.

Try to identify a few more examples of problems for micro-economics analysis. Set your Dymedia at setting H. Be sure to insert a new response card. Start with line 1 to correspond with problem 1.

Label each of the following which is a problem suitable for micro-economics analysis "b" and each which is not suitable "a."

1. Mr. Irving R. Good was elected president of the Chicago Board of Trade.
2. The General Electric Plant in Daytona Beach laid off 2000 workers, causing a grave employment problem.
3. The cost of living index in the U.S. rose one per cent in September.
4. The Howard Johnson Corporation wants to expand its motel business to include the Southwest.
5. Unemployment in the U.S. declined during July and August.
6. The Columbia Broadcasting System purchased Rand McNally Co.

If you had any difficulty with the above, read McConnell, pp. 16-17.

OBJECTIVES NEEDING SPECIAL HANDLING
(Sample B or C)

Segment 19

1704 - Sample C
1711 - Sample C
1793 - Sample C

Segment 20

None

Segment 21

None

Segment 22

1536 - Sample C
1594 - Sample C

Segment 23

None

Segment 24

2038 - Sample B
2041 - Sample B
2042 - Sample C
2044 - Sample B

Segment 25

None

Segment 26

None

Segment 28

2126 - Sample C
2151 - Sample B
2196 - Sample B

Segment 29

None

Segment 30

None

Segment 31

None

Segment 32

None

Segment 33

None

Segment 34

None

Segment 35

None

Segment 36

None

Segment 37

None

Segment 38

2570 - Sample B

Segment 40

2613 - Sample B

Segment 41

None

Segment 42

None

Segment 43

2747 - Sample B

Segment 44

2750 - Sample B

Segment 45

None

Segment 46

2760 - Sample B
2763 - Sample B

#14

Notes to Economists

S = Student

SEGMENT 19

Somewhere in this segment S must learn that income produced is equal to income earned.

Objectives

1740	Student may need to distinguish between "total value of production" learned in objective 1349 and "total market value" of objective 1740. S will need to learn meaning of terms: final goods and services, and the letters GNP. S will need to learn that the market value of a product is the same as its price.
1711	Possibly some examples of "illegal transactions" should be included.
1757	S will need to learn the term: intermediate goods.
1792	S will need an explanation of "present year." Is this fiscal or calendar? Does objective refer to "final" goods and services"?
1703	Since S is asked to differentiate between examples of "final" and "intermediate" goods, students should learn definitions of these terms.
1716	The term "value added" should be related to problem of "double counting" and to GNP.
1726	This method of obtaining GNP should be related to method described in 1740. Full explanation of each method and their difference is required.

Notes to Economists

S = Student

SEGMENT 20

Throughout this segment instructional materials should provide opportunities for S to learn the meaning of symbols such as I_g, I_n, etc.

Objectives

1631 Students may need an explanation of the term "economic welfare," and should relate this to objectives 1698 and 1699 (Inflation and Deflation).

1695 Specific examples are needed, e.g., There is a 10% increase in prices over a 12 month period, and GNP is up 25 billion for the same period. Is this a real change in GNP?

Notes to Economists

S = Student

SEGMENT 21

S must recall that income produced is equal to income earned.

Objectives

1746 S will need an explanation of and examples of the term "capital improvement."

1797 S should learn the terms: depreciation, replacement investment, and capital stock.

1783 S should be informed that "capital consumption" is part of or related to "depreciation."

1715 S will need explanation of terms incorporated and unincorporated businesses.

1753 Perhaps a definition is needed here and/or an explanation of how this is determined.

1788 S may need to know how this is determined.

1780 S should learn what is meant by the term "net output (value less depreciation)."

Notes to Economists

S = Student

SEGMENT 22

Objectives

1594 S will need to know or review formula; also needs to learn the meaning of the term "function" as in "savings function."

1536 Same comments as in 1594 but for "consumption function."

1522 S must learn formula $\frac{\Delta c}{\Delta Y}$

1591 S must learn formula for this statement.

Notes to Economists

S = Student

SEGMENT 23

In this segment S should learn symbols MPS and MPC and what they represent.

Notes to Economists

S = Student

SEGMENT 24

Objectives

2037 S will need an explanation and examples of the terms "real capital and capital goods."

Notes to Economists

S = Student

SEGMENT 25

Before learning the objectives for this segment, there should be a review of "opportunity costs." S should learn the meaning of the terms: level of investment and profit.

Notes to Economists

S = Student

SEGMENT 26

Objectives

2008 S should learn (r) = market interest rate.

Notes to Economists

S = Student

27/ SEGMENT 28

Objectives

2123 Prior to learning this objective, S should review meaning of : economic model, meaningful aggregates, consumption, and investment.

Notes to Economists

S = Student

SEGMENT 29

Objectives

2149 S should identify full employment level of income on a graph in addition to giving verbal explanation of it.

2195 S should review the meaning of "market equilibrium" and be able to identify point of market equilibrium on a graph.

2153 S should review the conditions which account for the existence of market equilibrium.

Notes to Economists

S = Student

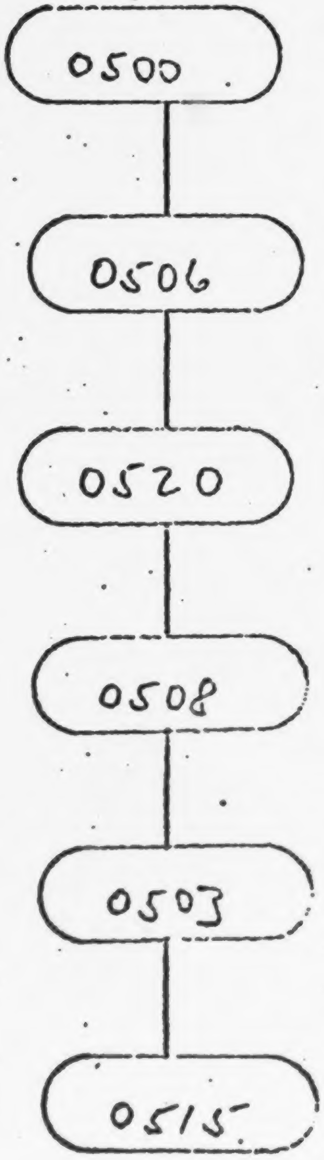
SEGMENT 30

Objectives

2102	S must receive background information concerning "stock and flow" and how they are related to the segment topics.
2125	S should review meaning of ex ante and ex post.
2158	Before learning this objective S should review the meaning of "leakages" and "injections" as they pertain to the circular flow.

SEGMENT 6

OBJECTIVES HIERARCHY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0515 Conditions: When asked to select from a list, the correct description of what is meant by "absolute advantage,"

Performance: The student will be able to identify as correct an answer equivalent to: "An absolute advantage exists when, for the same amount of physical inputs, a production unit (nation, region, firm, etc.,) produces a greater output of a given commodity than another production unit."

Criterion: Implicit.

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0515 A "Absolute advantage" exists when

a. For the same investment, a producer can accumulate more factor or resource inputs to increase production.

b. For the same amount of inputs, a nation can produce more of a given output than another nation or region.

c. One producer still out-produces another, although relatively deprived of a certain amount of factor inputs.

d. More of a product is produced, regardless of the amount of factor inputs.

ANSWER: b.

0515B Which of the following best describes what is meant by absolute advantage?

a. Two producers have different opportunity costs in production.
b. Two producers have equal opportunity costs in production.
c. Two producers have the same amount of physical inputs, but one produces more of the given output.
d. Absolute amounts of output are produced regardless of resource inputs.

ANSWER: c

0515C Which of the following best completes this statement, "______________________________" exists when given the same amount of inputs, more output is produced by one nation than by another for all products concerned.

a. Division of labor
b. Comparative advantage
c. Specialization
d. Absolute advantage

ANSWER: d

0515D Which of the following conditions most likely exists when, given equal amounts of inputs, more of a product is produced by one nation than by another?

a. Absolute advantage
b. Comparative advantage
c. Specialization
d. a and c above

ANSWER: a

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0503 Conditions: Given a table of hypothetical data about two producers (countries, urban areas, individuals) engaged in production of two products wherein one producer has an absolute advantage over the other in some, or in all, products,

Performance: The student will identify which producer has the absolute advantage.

Criterion: Implicit.

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0503 A Both Israel and Korea produce passenger car tires and blankets. Study the following table carefully, and select the alternative which best represents the pattern of absolute advantage in the production of these goods by these two nations.

(Note: Figures = 00 tires and blankets produced per fifty man-hours.)

Nation	Blankets	Tires
Israel	30	80
Korea	40	30

a. Israel has an absolute advantage in blankets as well as passenger tires.

b. Korea has an absolute advantage in both blankets and passenger tires.

c. Korea has an absolute advantage in passenger tires, while Israel has an absolute advantage in blankets.

d. Israel has an absolute advantage in passenger tires, while Korea has an absolute advantage in blankets.

ANSWER: d.

0503 B Both Germany and Japan produce cameras and radios. Study the following table carefully and select the statement which best represents the pattern of absolute advantage in the production of these products by these two countries.

(Note: Figures = 000 units/100 man-hours of production.)

Country	Cameras	Radios
Germany	75	65
Japan	56	70

a. Japan has an absolute advantage in both cameras and radios.

b. Germany has an absolute advantage in cameras, while Japan has an absolute advantage in radios.

c. Japan has an absolute advantage in cameras, while Germany has an absolute advantage in radios.

d. Neither Germany nor Japan has an absolute advantage in either cameras or radios.

ANSWER: b

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0503 C Both Boeing and Lockheed produce military and commercial aircraft. Study the table below and select the statement which best identifies the pattern of absolute advantage in the production of these aircraft by the two companies.

(Note: Figures = the number of units produced/ hundred man-hours).

Firm	Military	Commercial
Lockheed	36	35
Boeing	40	31

a. Neither Boeing nor Lockheed has an absolute advantage in either type of aircraft.

b. Boeing has an absolute advantage in military craft, while Lockheed has an absolute advantage in commercial craft.

c. Lockheed has an absolute advantage in military craft, while Boeing has an absolute advantage in commercial craft.

d. Boeing has an absolute advantage in both commercial and military craft.

ANSWER: b

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0503 D Both Bell Aerosystems, Inc. and Hughes Aircraft Corp. make fixed-wing and rotor-powered aircraft. Study the following table carefully, and select the statement given below, which best represents the pattern of absolute advantage in the production of these types of aircraft by the two companies. (Note: figures represent the number of units produced per month.)

Firm	Fixed	Rotor
Bell	300	500
Hughes	500	300

a. Bell has an absolute advantage in fixed-wing craft while Hughes has an absolute advantage in rotor craft.

b. Both Bell and Hughes have an absolute advantage in rotor craft.

c. Hughes has an absolute advantage in fixed-wing craft while Bell has an absolute advantage in rotor-powered craft.

d. Neither Bell nor Hughes has an absolute advantage in either one of the two types of craft.

ANSWER: c

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0508 Conditions: Given several statements describing what is meant by "comparative advantage,"

Performance: The student will select as correct the statement equivalent to: "When two productive units are producing the same two products, and one productive unit produces one of the products at a relatively lower differential real cost than it produces the other product, a condition of 'comparative advantage' is said to exist for the product which has the relatively lower differential real cost--even though an 'absolute advantag for this product may still exist for the oth producer."

Criterion: Implicit.

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0508 A Which of the following correctly describes a condition of comparative advantage?

a. Comparative advantage exists when a production unit has absolute efficiency in the production of all goods at all times.

b. Comparative advantage exists for the product with lower real cost when one of two productive units, both of which produce the same commodities, produces one good at a relatively lower cost than it produces the other, even though the other producer may have an absolute advantage for this good.

c. Comparative advantage exists when a production unit produces specified outputs at constant real costs.

d. Comparative advantage exists for that product for which one of two productive units, both of which are producing the same products, has a smaller absolute advantage.

ANSWER: b.

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0508 B Which of the following correctly describes a condition of comparative advantage?

a. When one of two productive units, both of which produce the same goods, produces one of the goods at lower real costs than the other goods, a comparative advantage exists for the product with the lower cost, although the other producer has an absolute advantage in that product.

b. When one of two production units has absolute advantage in the production of all goods at all times, a comparative advantage is said to exist.

c. When one of two production units is able to produce relatively greater amounts of a good for relatively higher costs than the other producer, he is said to have a comparative advantage.

d. Comparative advantage depends only on relative costs; the higher the relative costs, the greater the comparative advantage.

ANSWER: a

0508 C A comparative advantage is said to exist when a production unit:

a. Produces specified outputs at constant real costs.

b. Produces specified units of a given good at relatively lower costs than those of another product.

c. Has an absolute advantage in all goods at all times.

d. Has lower absolute costs than another unit producing similar goods.

ANSWER: b

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0520 Conditions: When asked to select from a list the factors which account for the existence of a comparative advantage in production,

Performance: The student will identify as correct the equivalent of, differences in technology, resource supplies, and climate.

Criterion: Implicit.

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0520A What are the factors which account for the existence of a comparative advantage in production?

a. Differences in technology
b. Differences in climate
c. Differences in resource supplies
d. All of the above

ANSWER: d

0520 B What are the main factors which account for the existence of a comparative advantage in production?

a. Differences in technology, resource supplies, and climate.

b. Differences in resource supplies, demand, and education.

c. Differences in education, government aid, resource allocation.

d. Any of the above.

ANSWER: a.

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0520 C Differences in climate, technology, and resource supplies are factors which account for the existence of:

a. An absolute advantage in distribution.
b. An increase in resource allocation.
c. A change in supply.
d. A comparative advantage in a product.

ANSWER: d.

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0520 D Which of the following is not considered to be a factor in the existence of a comparative advantage in production?

a. Differences in technology.
b. Difference in resource supplies.
c. Differences in climate.
d. Differences in tastes and preferences.

ANSWER: d.

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0506 Conditions: Given a table of outputs per unit of labor for two products and two producers (capital and land for this product being equivalent for both producers),

Performance: The student will identify the product in which each producer has a comparative advantage.

Criterion: Implicit.

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0506 A Both John and Simon own auto body shops, and both remove dents and paint cars using a spray apparatus. Study the following table carefully and identify the task or tasks in which each man has a comparative advantage. (Note: Figures represent units of output per man-hour.)

Firm	Dents	Paint
Simon	5	4
John	4	3

a. John has a comparative advantage in removing dents, while Simon has a comparative advantage in painting cars.

b. Both John and Simon have a comparative advantage in painting cars.

c. Neither John nor Simon has a comparative advantage in either task.

d. Simon has the advantage in removing dents, while John has the advantage in painting.

ANSWER: a

0506 B Both the Guarantee Computer Service Co. and the Reliable Electronics Co. are engaged in computer sales and service. Study the following table and select the alternative which best describes the pattern of comparative advantage in this case. (Figures represent units of output per 40 man-hours.)

Firm	Sales	Service
Guarantee	14	12
Reliable	12	6

a. Guarantee has a comparative advantage in both sales and service.

b. Guarantee has a comparative advantage in sales, while Reliable has a comparative advantage in service.

c. Guarantee has a comparative advantage in service, while Reliable has a comparative advantage in sales.

d. Neither Reliable nor Guarantee has an advantage in either type of business.

ANSWER: c

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0506 C Hitt and Block both own farms on which they graze cattle on part of the acreage and grow wheat on the other part. All the land is suitable for either activity. Study the following table and select the alternative which best describes the pattern of comparative advantage in this case. (Figures represent units of output per man-hour.)

Farmer	Wheat	Beef
Hitt	50 bu.	20
Block	70 bu.	50

a. Block has a comparative advantage in wheat, while Hitt has a comparative advantage in beef.

b. Block has a comparative advantage in beef, while Hitt has a comparative advantage in wheat.

c. Neither Block nor Hitt has a comparative advantage in either product.

d. Block has a comparative advantage in both wheat and beef.

ANSWER: b

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0506 D Both Maryland and Louisiana produce tobacco and peanuts. Study the following table carefully and select the alternative which best describes the pattern of comparative advantage in this case. (Figures represent bushels of output per 10 man-hours.)

State	Tobacco	Peanuts
Maryland	60	80
Louisiana	50	60

a. Maryland has a comparative advantage in peanuts, while Louisiana has a comparative advantage in tobacco.

b. Neither Maryland nor Louisiana has a comparative advantage in either crop.

c. Maryland has a comparative advantage in tobacco, while Louisiana has a comparative advantage in peanuts.

d. Maryland has a comparative advantage in both crops.

ANSWER: a

0500 Conditions: Given examples of: comparative, absolute and no advantage and a list of explanations of why each type of advantage exists,

Performance: The student will:

(1) identify each type of advantage correctly.

(2) identify the correct explanations of why each type of advantage exists.

Criterion: Implicit.

0500A Part One

Both Firm A and Firm B produce #20 and #30 oil. Each wishes to use these two oils to produce a new product which requires a mixture of these oils. The tables below show the output of each kind of oil for each firm using the same mixture ratio. Study the tables carefully. Then, answer the questions.

(1)

firm	#20 oil	#30 oil
A	40	30
B	40	30

(2)

firm	#20 oil	#30 oil
A	40	20
B	30	40

(3)

firm	#20 oil	#30 oil
A	40	30
B	30	20

(figures = barrels per 100 man hours)

Which of the following states correctly the advantage illustrated by each table?

a. (1) illustrates comparative advantage, (2) illustrates absolute advantage, (3) illustrates no advantage.

b. (1) illustrates absolute advantage, (2) illustrates comparative advantage, (3) illustrates no advantage.

c. (1) illustrates absolute advantage, (2) illustrates no advantage, (3) illustrates comparative advantage.

d. (1) illustrates no advantage, (2) illustrates absolute advantage for each producer, (3) illustrates comparative advantage.

ANSWER: d

0500A **Part Two**

Study the following tables carefully.

The following tables refer to the situation in question 0500 A Part One.

(1)

firm	#20 oil	#30 oil
A	40	20
B	30	40

(2)

firm	#20 oil	#30 oil
A	40	30
B	30	20

(3)

firm	#20 oil	#30 oil
A	40	30
B	40	30

(figures = barrels per 100 man hours)

Which of the following best explains why each type of advantage exists in the relationships shown above?

a. Absolute advantage exists in (1) because given the same amount of factor inputs, Firm A can produce more #20 oil and Firm B can produce more #30 oil. Comparative advantage exists in (2) because Firm A has a greater absolute advantage in #20 oil and Firm B has less absolute disadvantage in #30 oil. No advantage exists in (3) because both firms produce the same amounts of each commodity.

b. Comparative advantage exists in (1) because Firm A has a higher relative output per factor input than Firm B. Table (2) is characterized by no advantage because each firm produces equal amounts in at least one of their commodities. Absolute advantage exists in table (3) because each firm produces more #20 oil than #30 oil.

c. No advantage exists in (1) because Firm A produces as much #20 oil as Firm B produces #30 oil. Likewise, no advantage exists in the relationships shown in table (2) because A produces as much #30 oil as Firm B produces #20 oil. Absolute advantage exists in (3) because each firm produces equal amounts of #20 oil and #30 oil.

d. Absolute advantage exists in (1) because given the same amount of factor inputs, Firm B can produce more #20 oil and Firm A can produce more #30 oil. Comparative advantage exists in (2) because Firm B has more of an absolute advantage in #20 oil and Firm A has less of an absolute advantage in #30 oil. No advantage exists in (3) because both firms produce the same amounts of each commodity.

ANSWER: a

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0500 B (1) K.O. Hitt and O.K. Punch own adjacent farms. Both use part of their acreage for grazing beef cattle, and on the other part they grow wheat. Both the price of wheat and the price of beef are rising, and the men wish to increase their income.

Study the tables below. Then, answer the questions.

Farmer	Wheat	Beef
Hitt	700	350
Punch	700	350

(1)

Farmer	Wheat	Beef
Hitt	800	450
Punch	700	600

(2)

Farmer	Wheat	Beef
Hitt	800	450
Punch	700	300

(3)

Which of the following best describes the types of advantage illustrated by the tables?

a. Table 1 illustrates comparative advantage; Table 2 illustrates no advantage; Table 3 illustrates no advantage.

b. Table 1 illustrates no advantage; Table 2 illustrates absolute advantage; Table 3 illustrates comparative advantage.

c. Table 1 illustrates absolute advantage; Table 2 illustrates no advantage; Table 3 illustrates comparative advantage.

d. Table 1 illustrates absolute advantage; Table 2 illustrates comparative advantage; Table 3 illustrates no advantage.

ANSWER: b.

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0500 B (2)

(1)

Farmer	Wheat	Beef
Hitt	700	350
Punch	700	350

(2)

Farmer	Wheat	Beef
Hitt	800	450
Punch	700	600

(3)

Farmer	Wheat	Beef
Hitt	800	450
Punch	700	300

Which of the following correctly explains why each type of advantage exists?

a. Comparative advantage exists in Table 1 because Punch has a greater absolute advantage in wheat, while Hitt has less of an advantage in beef. No advantage exists in Table 2 because Hitt and Punch have equal outputs of wheat and beef respectively. No advantage exists in Table 3 because Hitt and Punch produce equal amounts of beef and wheat respectively.

b. No advantage exists in Table 1 because both firms produce the same amount of each commodity. Absolute advantage exists in Table 2 because given the same amount of factor inputs, Hitt can produce more wheat and Punch can produce more beef. Comparative advantage exists in Table 3 because Hitt has a greater absolute advantage in wheat, and Punch has less absolute disadvantage in beef.

c. Absolute advantage exists in Table I because both firms produce more wheat than beef. Comparative advantage exists in Table 2 because Hitt outproduces Punch in wheat, and Punch outproduces Hitt in beef. No advantage exists in Table 3 because Hitt outproduces Punch in both wheat and beef.

d. Comparative advantage exists in Table 1 because more wheat than beef is produced. Absolute advantage exists in Table 2 because the wheat production of Hitt equals that of Punch in beef. No advantage exists in Table 3 because Hitt outproduces Punch in both wheat and beef.

ANSWER: b.

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0500C (1) Both Maryland and Louisiana produce tobacco and peanuts. However, the farmers in both states would like to specialize. Study the output tables carefully, and then answer the questions.

(1)

State	Tobacco	Peanuts
Maryland	200	100
Louisiana	150	50

(2)

State	Tobacco	Peanuts
Maryland	50	100
Louisiana	50	100

(3)

State	Tobacco	Peanuts
Maryland	100	200
Louisiana	200	50

(Figures = Bu/100 man-hours)

Which of the following lists identifies correctly the type of advantage illustrated by each table?

a. Table 1 illustrates absolute advantage; Table 2 illustrates no advantage; Table 3 illustrates comparative advantage.

b. Table 1 illustrates no advantage; Table 2 illustrates absolute advantage; Table 3 illustrates comparative advantage.

c. Table 1 illustrates comparative advantage; Table 2 illustrates no advantage; Table 3 illustrates absolute advantage.

d. Table 1 illustrates comparative advantage; Table 2 illustrates absolute advantage; Table 3 illustrates no advantage.

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ANSWER: a

0500 C (2) Both Maryland and Louisiana produce tobacco and peanuts. However the farmers in both states would like to specialize. Study the following output tables carefully, and then answer the questions.

(1)

State	Tobacco	Peanuts
Maryland	200	100
Louisiana	150	50

(2)

State	Tobacco	Peanuts
Maryland	50	100
Louisiana	50	100

(3)

State	Tobacco	Peanut
Maryland	100	200
Louisiana	200	50

(Figures = bu./100 man-hours)

Which of the following correctly explains why each type of advantage exists, as illustrated in each table?

a. No advantage exists in (1) because Maryland produces as much tobacco as Barten produces peanuts. Absolute advantage exists in (2) because both Maryland and Louisiana produce more peanuts than tobacco. Comparative advantage exists in (3) because both Maryland and Louisiana have an advantage in one product and a disadvantage in the other.

b. Absolute advantage exists in (1) because Maryland outproduces Louisiana in both tobacco and peanuts. No advantage exists in (2) because both Maryland and Louisiana produce more peanuts than tobacco. Comparative advantage exists in (3) because both Maryland and Louisiana have an advantage in one product and a disadvantage in the other.

c. Comparative advantage exists in (1) because Maryland produces as much peanuts as Louisiana produces tobacco. Absolute advantage exists in (2) because both states produce more peanuts than tobacco. Comparative advantage exists in (3) because Louisiana produces as much tobacco as Maryland produces peanuts.

d. Comparative advantage exists in (1) because Maryland has a greater absolute advantage in peanuts, and Louisiana has less absolute disadvantage in tobacco. No advantage exists in (2) because both states produce the same amount of each product. Absolute advantage exists in (3) because given the same amount of resource inputs, Maryland produces more peanuts, and Louisiana produces more tobacco.

ANSWER: d

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0500D(1) Both Pure and Blanc Brothers produce detergent and bleach. Each wishes to produce a new product using both detergent and bleach. The tables below show the output of bleach and detergent for each firm. Study the tables carefully. Then, answer the questions.

Firm	Detergent	bleach
Pure	45	30
Blanc	45	30

(1)

Firm	Detergent	Bleach
Pure	45	10
Blanc	25	45

(2)

Firm	Detergent	Bleach
Pure	45	25
Blanc	25	10

(3)

(figures = 1000 pounds / 100 man-hours)

Which of the following identifies correctly the type of advantage illustrated by each of the tables given above?

a. Table 1 illustrates no advantage; Table 2 illustrates absolute advantage; Table 3 illustrates comparative advantage.

b. Table 1 illustrates comparative advantage; Table 2 illustrates no advantage; Table 3 illustrates absolute advantage.

c. Table 1 illustrates comparative advantage; Table 2 illustrates absolute advantage; Table 3 illustrates no advantage.

d. Table 1 illustrates absolute advantage; Table 2 illustrates comparative advantage; Table 3 illustrates no advantage.

ANSWER: a

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0500D(2) The following tables refer to the situation in question 0500D(1).

Firm	Detergent	bleach
Pure	45	30
Blanc	45	30

(1)

Firm	Detergent	Bleach
Pure	45	10
Blanc	25	45

(2)

Firm	Detergent	Bleach
Pure	45	25
Blanc	25	10

(3)

Which of the following correctly explains why each type of advantage exists, as illustrated in the tables given above?

a. Absolute advantage exists in (1) because both Pure and Blanc Bros. produce more detergent than bleach. Comparative advantage exists in (2) because Pure produces more detergent, and Blanc Bros. produces more bleach. No advantage exists in (3) because Pure outproduces Blanc Bros. in both detergent and bleach.

b. No advantage exists in (1) because both firms produce the same amount of each product. Absolute advantage exists in (2) because given the same amount of resource inputs, Pure produces more detergent, and Blanc Bros. produces more bleach. Comparative advantage exists in (3) because Pure has a greater absolute advantage in bleach, and Blanc Bros. has less absolute disadvantage in detergent.

c. No advantage exists in (1) because both Pure and Blanc Bros. produce the same amount of each product. Comparative advantage exists in (2) because Pure produces more detergent and Blanc Bros. produces more bleach. Absolute advantage exists in (3) because Pure outproduces Blanc Bros. in both detergent and bleach.

d. Comparative advantage exists in (1) because more detergent is produced in comparison to bleach. No advantage exists in (2) because Pure has an advantage in one product, while Blanc Bros. has the advantage in the other. Absolute advantage exists in (3) because Pure outproduces Blanc Bros. in both products.

ANSWER: b

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EVENT SHEET # 7

Principle Learning

Objective # 0515.

Segment # 6.

1. Inform Learner of performance required: Student is informed that he will identify the meaning of absolute advantage as: "An absolute advantage exists when for the same amount of physical inputs, a production unit (nation, region, firm, etc.) produces a greater output of a given commodity than another production unit."

2. Stimulate recall of component concepts: Student is asked what is meant by physical inputs.

3. Verbal cueing: Suppose you are given the same amount of time, effort and investment, as your competition. You produce more than your competition in the same commodity. What kind of advantage would you have?

4. Appraisal: Test item 0515 A.

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APPENDIX D

Economics Course Outline

Block Number	Segment I.D. Number	Segment Description	*Media Strateg
0[illegible]	1	Orientation	G/P-D-1
004	2	Test: Pre-test for core segments 4 through 15	G/H-M
006	3	Counsel, prescribe	G-I/P
008	4	Core Learning - Definition of Economics - Economics a social science - Reason for studying Economics - Micro & Macro levels of Economics	G/P-D
010	5	Core Learning - Sources of error in economic reasoning - Typical economic goals - Definition of economic theory - Definition and advantages of economic models	I/A-H-M
012	6	Core Learning - Specialization (Rationale) . absolute advantage . comparative advantage	I/A-H-M
014	7	Core Learning - Specialization . basis for trade . advantages and disadvantages . increased output (welfare)	I/A-H-M
016	8	Core Learning - Demand . definition . law of . graphical representations . determinants of DD . effect of changes of determinants normal versus inferior goods intra-relationships	I/A-H-M and I/A-H-M

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* See page A-1 for key to symbols below.

Block Number	Segment I.D. Number	Segment Description	*Media Strate
018	9	Core Learning - Supply . definition . law of . graphical representations . determinants of SS . effect of Δ determinants intra-relationships	I/A-H-M- and I/A-H-M-
020	10	Core Learning - Equilibrium . definition . graphical representations . stability conditions - implications . effect of ΔSS and DD determinants . "excess" supply and demand . equilibrating process	I/A-H-M- and I/A-H-M-
022	11	Test and Counsel - Unit test on core segments 4 through 10; prescription/counsel	G-I/H-M-
024	3R-1	Remediation - Lack of prerequisites learning time (variable in length).	Mixed
026	5E-0	Test and Counsel - Pretest of segments 5E-1 and 5E-2; prescribe	I/H-M-
028	5E-1	Enrichment - Scarcity - Production possibilities - PP curves . definition . shape . use - Law of increasing costs - Output possibilities	I/A-H- and I/A-H-
030	5E-2	Enrichment - Production possibilities (Applications) - Effect of changing parameters - Developed nations - Investment (Future goods) - Production (Present goods)	I/A-H- and I/A-H-
032	5E-3	Test and Prescribe - Pre-test on enrichment segments 5E-1 through 5E-2; prescribe	I/H-M-

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Block Number	Segment I.D. Number	Segment Description	*Media Strate
0[illegible]	5E-3	Test and Prescribe - Pre-test on enrichment segments 11E-1 through 11E-3; prescribe	I/H-M-P
036	11E-1	Enrichment - Spectrum of Economic Systems	I/A-H-M
038	11E-2	Enrichment - Spectrum of Economic Systems	I/A-H-M
040	11E-3	Enrichment - Spectrum of Economic Systems	I/A-H-M
042	11E-4	Test and Prescribe - Post test on enrichment segments 11E-1 through 11E-3	I/H-M-P
050	11R-1	Remediation - Remedial learning and retest (remedial time is variable in length)	Mixed
060	12	Core Learning - Decision Makers . Households . Firms . Government - Role of Decision makers - Uses of income, etc.	I/A-H-M
062	13	Core Learning - flow of . resources . money income . consumption expenditures . goods and services - flow between households and firms - product and resource markets	I/A-H-M
064	14	Core Learning - Circular flow between decision makers - Intra-relationship of factors in circular flow models	I/A-H-M
068	15	Core Learning - circular flow and the economic system . volume of flow . leakages . injections - essential system element - "aggregations of individuals"	I/A-H-M
[illegible]	16	Test - Post test on core segments 4 - 15	G/H-M

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lock Number	Segment I.D. Number	Segment Description	*Media Strateg
072	17	Counsel - counsel and prescribe	G-I/P
074	15E-0	Test and Counsel - Pre-test on enrichment segments 15E-1 through 15E-3; prescribe	G-I/H-M-
076	15E-1	Enrichment - Circular flow	I/A-H-M
078	15E-2	Enrichment - Circular flow	I/A-H-M
080	15E-3	Enrichment - Circular flow	I/A-H-M
082	15E-4	Test and Counsel - Post test on enrichment segments 15E-1 through 15E-3; prescribe	G-I/H-M-
084		Seminar #1 - Motivational	G/P-D
086	17R-1	Remediation - Remedial learning time (variable in lengths)	Mixed

Block Number	Segment I.D. Number	Segment Description	*Media Strateg
100	18	Test and Prescribe - Pretest on core segments 19-26; prescribe	G-I/H-M
102	19	Core Learning (2.1/.2) National Income Measurement and National Income and Product Accounting . - Gross National Product (G.N.P.) . Definition ("Standard") . Exclusions from GNP . Double counting . Definition ("Value Added")	I/A-H-M
104	20	Core Learning National Income Measurement and National Income and Product Accounting (Cont'd.) - Problems in Monetary Measurement of GNP . Inflation . Deflation . Real changes vs price changes	I/A-H-M
106	21	Core Learning Nat'l Income Measurement & Product Accounting (cont'd.) - Gross Private Investment . Definition . Non-investment items - Net Private Investment . Definition . Contrasted with gross private investment - Net National Product (N.N.P.) . Definition . Contrasted with G.N.P. - National Income (N.I.) . Defined . Indirect business taxes . Contrasted with N.N.P. - Personal Income (P.I.) . Compared with N.I. - Transfer Payments - Disposable Income (Yd) - Personal Income Taxes $Tx_{P.I.}$. $Y_d = P.I. - Tx_{P.I.}$ - Definitions of Each of the Principal Accounting Concepts	I/A-H-M

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Block Number	Segment I.D. Number	Segment Description	*Media Strate
1	22	Core Learning (2.5) Behavioral Characteristics of Consumption and Investment (C & I) - Savings . Defined . Savings function - Consumption . Defined . Consumption function . Autonomous consumption . Induced consumption	I/A-H- --
110	23	Core Learning (2.5) Consumption and Investment (cont'd.) - $Y_d = C + S$ - MPS . Defined . Slope of savings function - MPC . Defined . Slope of consumption function - MPC + MPS + 1.00 - Computation of MPS and MPC	I/A-H-
112	24	Core Learning (2.5) C & I (cont'd.) - Investment . Defined . Plant investment . Equipment expenditures . Inventory . Purchase of homes . Determinants	I/A-H-
114	25	Core Learning (2.5) C & I (cont'd.) - Expected Profits - defined - Interest - defined . Opportunity costs . Marginal efficiency of capital (M.E.C.)	I/A-H-
116	26	Core Learning (2.5) C & I (cont'd.) - Interest (cont'd.) . M.E.C. (cont'd.) - M.E.C. schedule - Slope of M.E.C. curve . Influence of interest rate - Causes of Volatility of Investment	I/A-H-

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Block Number	Segment I.D. Number	Segment Description	*Media Strate
1	27	Test and Prescribe - Unit test on segments 19-26; prescribe	G/H-M-P
120		Seminar #2 - Motivational	G/P-D
122	27R-1	Remediation - Remedial learning time (variable in length) and retest	Mixed
150	28	Core Learning (2.6) Nat'l Income Equilibrium Model (2.6) - Producer Expectations - Consumer Expectations - C & I in a Two-Sector Model - Aggregate Demand . C & I schedule - Aggregate Supply . Graphical representation	I/A-H-M and G-I/A-T
152	29	Core Learning (2.6) Nat'l Income Equilibrium Model (cont'd.) - Full Employment Income - Unemployment - Actual and Potential NNP - Income Equilibrium . Defined . Graphical representation . Interpreted in terms of supply and demand . In two-sector model	I/A-H-M and G-I/A-H-
156	30	Core Learning (2.6) Nat'l Income Equilibrium Model (cont'd.) - Stocks and Flows - "Ex ante" savings & investment defined - "Ex post" savings & investment defined - $S = I$ - Equilibrium Point of Income	I/A-H-
158	31	Core Learning (2.6) Nat'l Income Equilibrium Model (cont'd.) - $S \neq I$ - Difference between "Ex post" and "Ex ante" saving - Consequences of ex ante S ≠ ex ante I. - Implications of equilibrium - S & I approach compared with aggregate supply and demand approach - Multiplier . Multiplier process . Algebraic description	I/A-H-

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Block Number	Segment I.D. Number	Segment Description	*Media Strate
160	32	Core Learning (2.6) Nat'l Income Equilibrium Model (cont'd.) - Multiplier (cont'd.) . Operation with respect to changes in I . Multiplier adjustments on C & * diagra - Y_e as a function of C, I, and S - Uniqueness of Y_e - Effect of Over-optimism of producers - Effect of Over-pessimism of producers	I/A-H-
162	33	Core Learning (2.8) Fiscal Policy - Deflationary Gap; Inflationary Gap . Necessary conditions . On C + I + G diagram . Consequences - Budget . Balanced budget defined . Budget surplus . Budget deficit - Stabilizing Economic Fluctuations . Counter-cyclical fiscal policy	I/A-H-
1	34	Core Learning (2.8) Fiscal Policy (cont'd.) -Stabilizing Economic Fluctuation (cont'd.) . Taxes (T_x) - Defined - Effect on C, I, & Y_e . Government expenditures (G) -Defined -Effect on C, I, & Y_e . G multiplier $>$ T_x multiplier . Changes in T_x and G to reach Full Employment Income . Stabilizing effects of T_x and G compared . Balanced budget multiplier -defined -why equal to 1.00	I/A-H-

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Block Number	Segment I.D. Number	Segment Description	*Media Strate
166	35	Core Learning (2.9) The Role of Money Money as a medium of exchange Meaning of "Function as a medium of exchange" Characteristics which allow money to function thusly Example of such functioning Money as Measure of Value Example Money as Store of Value Example Money as Standard of Deferred Payment Example Money Defined Functions Locus of Value Things which may serve as money Role of money in the economy	I/A-H-
168	36	Core Learning (2.10) The Money Supply Demand Deposits Definition Part of total money supply Form of money Assets, Liabilities & Balance Sheets D.D. as Asset; as Liability Fractional Reserve System Basic Operation	I/A-H-
170	37	Core Learning (2.10) The Money Supply (cont'd.) Fractional Reserve System (cont'd.) Premises Type of bank reserves (Assets) Required reserves Setting of requirements Excess reserves Source of loan funds Problem - example	I/A-H-
172	38	Core Learning The Money Supply (cont'd.) Fractional Reserve System (cont'd.) Excess Reserves (cont'd.) Expansion ratio Problems Reserve Deficiency Near Money Defined Examples of	I/A-H-

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Block Number	Segment I.D. Number	Segment Description	*Media Strate
1	39	Test and Counsel - Unit test on core segments 28-38; prescribe	G-I/H-
176	32E-0	Test and Counsel - Pretest on enrichment segments 32E-1 - 32E-4; prescribe	G-I/H-
178	32E-1	Three and Four Sector Equilibrium Effect of expectations of individual decision-makers. Elaboration of the condition that leakages equals injections, in the associated adjustment process.	I/A-H-
180	32E-2	The effect of induced investment on the multiplier. Additional numerical work with the investment multiplier. The paradox of thrift. The foreign trade multiplier.	
182	32E-3	Introduction of government into the model, and the impacts of taxes and government spending.	
184	32E-4	Additional numerical work with the four sector equilibrium model.	
186	32E-5	Test and Counsel - Post test on enrichment segments 32E-1 through 32E-4.	I/H-M-P
1		Seminar #3 - Motivational	G/P-D
190	39R-1	Remediation - Remedial learning time (variable in length) and retest	Mixed

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Block Number	Segment I.D. Number	Segment Description	*Media Strate
2	40	Core Learning The Federal Reserve System - American Banking System Composition - Federal Reserve System Description of Purposes Description of Functions Policy Making Body - the Board of Governors Functions Method of Choice of Governors Member Banks	I/A-H-
202	41	Core Learning The Federal Reserve System (cont'd.) - Controls of Bank Reserves Tools for Control Variation of Reserve Requirement Effect of Raising Effect of Lowering	I/A-H-
204	42	Core Learning The Federal Reserve System (cont'd.) - Variation of Discount Rate Effect of Decreasing Effect of Raising - Open Market Operations Open Market Committee Effect of Open Market Operations Securities Transactions Examples - Problems - Summary - Quantitative Credit Controls - Counter-cyclical Effects of Monetary Actions	I/A-H-
206	43	Core Learning The Product and Monetary Markets - Transactions Demand for Money Defined Main Determinant Graphical Representation Independence vis-a-vis Interest Rate Graphical Representation	I/A-H- and I/A-H-

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Block Number	Segment I.D. Number	Segment Description	*Medi Strat
208	44	Core Learning The Product and Monetary Markets (cont'd.) - Asset (or speculative) Demand for Money Explanation Main Determinant Negative Slope - Explanation Graphical Representation Effect of Decline in Interest Rates	I/A-H- and I/A-H- --
210	45	Core Learning The Product and Monetary Markets (cont'd.) - Total Demand for Money Defined As a Function of Interest Rate; Graphical Representation Shifts with Income Level - Supply of Money Supply Curve Determination of Money Supply - Determination of Interest Rate	I/A-H- and I/A-H-
211	46	Core Learning The Product and Monetary Markets (cont'd.) - Recall of level of investment as most volatile component in determination of equilibrium level of income. - Determinants of Level of Investment - Relation between money supply, rate of interest, and level of investment. Graphical representation of effect of change in money supply Influence of monetary policy on equilibrium level of income.	I/A-H- and I/A-H-
212	47	Core Learning - Open	Open
214	48	Test - Post test on segments 19 through 47	G/H-
216	49	Counsel - Counsel and prescribe	G-I/P
218	46E-0	Test and Counsel - Pretest on enrichment segments 46E-1 through 46E-n; prescribe	G-I/H-

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Block Number	Segment I.D. Number	Segment Description	*Medi Strat
220	46E-1	Enrichment - Monetary and Product Markets Equation of exchange Precautionary demand for money Effect of interest rates on transactions and precautionary demand for money Relationship between velocity and the Keynesian demand for money	I/A-H- --
222	46E-2	Enrichment - Monetary and Product Markets (Anticipated)	I/A-H-
224	46E-3		
226	46E-4	Test and Counsel - Post test on enrichment segments 46E-1 through 46E-n; prescribe	G-I/H-
228		Seminar #4 - Motivational	G/P-D
230	49R-1	Remediations - Remedial learning time (variable in length)	Mixed

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Block Number	Segment I.D. Number	Segment Description	*Medi Strat
300	50	Test and Counsel -- Pretest of segments 51-79; prescribe	G/H-M-P
302	51	Core Learning (3.1) Demand & Consumer Maximization Definition of Utility Total utility function Marginal Utility Total - Marginal Utility (relationship) Graphical illustrations	I/A-H-M-
304	52	Core Learning (3-1) Demand & Consumer Maximization Paradox of value Consumer equilibrium Relationship of MU on Demand	I/A-H-M-
306	53	Core Learning (3.3) Price elasticity of demand Elasticity coefficients Graphical representations Consumer behavior effects	I/A-H-M-
3[illegible]	54	Core Learning (3.3) Relation to total revenue Income elasticity of demand Significance of coefficients Levels of Income/demand	I/A-H-M-
310	55	Core Learning (3.6) Short run cost Fixed and variable costs Averaged fixed and variable costs Total cost - average total costs Curve analysis	I/A-H-M and I/A-H-M
312	56	Core Learning (3.6) Marginal cost (S.R.) AVC and ATC Determinants of MC Calculate MC Relationships of curves: TC, ATC, MC, VC, AVC, FC, AFC	I/A-H-M and I/A-H-M

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Block Number	Segment I.D. Number	Segment Description	*Media Strate
314	57	Core Learning (3.6) Definition of SR supply curve Significance of curve intercepts: MC - AVC, MC - AC Significance of "SR Supply Curve" Segments: AVC to AC Intercepts Below AVC Intercept Above AC Intercept Firm supply from supply curve.	I/A-H-M and I/A-H-M
316	58	Core Learning (3.8) Definition of long run Long run cost curves Short run to long run curves Expanding plant capacity	I/A-H-M and I/A-H-M
318	59	Core Learning (3.8) Economies of scale Internal/external - economies/diseconomies Shifts on and of LR-ATC curve	I/A-H-M and I/A-H-M
320	60	Core Learning (3.8) Effect of Δ D - Long run & short run LR-ATC curve analysis S-D curve analysis Relationship between SD and LR-ATC curves	I/A-H-M and I/A-H-M
322	61	Test and Counsel - Unit test on core segments 51 through 60; prescribe	G-I/H-M
324		Seminar #5 - Motivational	G/P-D
326	61R-1	Remediation - Remedial learning time (variable in length) and retest	Mixed
350	62	Core Learning (3.9/.10/.11) Firm demand - Industry demand Industry equilbirium Marginal & Average Revenue Relationships of above	I/A-H-M and I/A-H-M
352	63	Core Learning (3.9/.10/.11) Cost-Price Equilibrium Price Maximization SR & LR Equilibrium Determinants of LR & SR firm equilibrium Maximization of Profit LR & SR	I/A-H-M

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Block Number	Segment I.D. Number	Segment Description	*Medi Strat
3	64	Core Learning (3.9/.10 .11) Exit & Entry criteria (LR & SR) Rationale for dynamics of equilibrium Consequences of entry and exit	I/A-H- --
356	65	Core Learning (3.1/.10/.11) Definition & characteristics of monopoly Firm and Industry demand Elasticity of demand (monopoly) Shape of demand/average revenue curve Derivation of MR from AR Significance of MR-MC intercept	I/A-H-
358	66	Core Learning (3.9/.10/.11) Consequences of changes in technology Consequences of changes in demand SR - equilibrium LR - equilibrium LR equilibrium in competitive and in monopolistic environment	I/A-H-
3	67	Core Learning (3.9/.10/.11) Definition of Monopolistic Competition Firm and Industry Elasticity Characteristics of S&D Curves Product variation, selling expense price competition Effect of changes in selling expense on firm & industry curves Effect of ΔP on firm and industry curves Effect of product variation on firm and industry curves	I/A-H-
362	68	Core Learning (3.9/.10/.11) Tangency solution of market equilibrium Short run equilibrium Long run equilibrium	I/A-H-
364.	69	Core Learning (3.9/.10/.11) Comparative price, quantity and profit equilibrium for industry under Monopolistic, Competitive and Monopolistic Competitive market situations. Advantages and disadvantages of Monopolistic Competition	I/A-H-

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Block Number	Segment I.D. Number	Segment Description	*Media Strate
3	70	Core Learning (3.9/.10/.11) Oligopoly definition characteristics price, quantity, selling cost, & product variation behavior Nonequilibrating behavior Collusion & price leadership	I/A-H-M --
368	71	Core Learning (3.9/.10/.11) Comparison of supply, demand, cost and revenue curves characteristic of Competitive, Monopoly, Monopolistic Competition and Oligopoly market situations. Relationship of P. q. & π in various market situations	I/A-H-M
370	72	Test and Counsel - Unit test on segments 62 through 71; prescribe	G-I/P-M
372		Seminar #6 - Motivational	G/P-D
374	72R-1	Remediation - Remedial learning time (variable in length) and retest	Mixed

Block Number	Segment I.D. Number	Segment Description	*Media Strate
400	74	Core Learning (3.13) Marginal Physical Product Demand for a factor . productivity . final product Derived Demand Demand for a factor as a schedule	I/A-H-M
402	75	Core Learning (3.13) Shifts in demand for factor inputs Elasticity of demand for factor inputs Substitution and Complementary effects Effect of Δ P on a factor Derivation of Market Demand	I/A-H-M
404	76	Core Learning (3.13) Supply side: characteristics of land labor capital Average factor costs Marginal factor costs Income to factors Optimizing action of resources	I/A-H-M
406	77	Core Learning (3.14) Determinants of the demand for labor Elasticity of demand for labor Sources of demand for labor Firm, industry and aggregate demand Equilibrium in labor market	I/A-H-M
408	78	Core Learning (3.18) Imperfections in Labor Market - Natural: Supply side, Demand side - Unnatural: Supply side, Demand side Effects of Impediments	I/A-H-M
410	79	Core Learning (3.19) Distribution of GNP - Size distribution . definition . significant factors . Cause - effect rationale - Functional distribution . definition . factors . cause - effect rationale	I/A-H-M

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Block Number	Segment I.D. Number	Segment Description	*Media Strate
412	83	Test - Post test on core segments 51 through 79	G-I/H-
414	84	Counsel - Counsel and prescribe	G-I/P
416	84R-1	Remediation - Remedial learning time (variable in length) and retest	Mixed
450	85	Test and Counsel - Pretest on segments 86 through 94; prescribe	G/H-M-
452	86	Core - The Theory and Benefits of Trade Statement of comparative advantage Problems identifying pattern of comparative advantage Advantages of international trade and lending Costs of international borrowing or lending Effect of trade on prices of goods and factors of production	I/A-H-
454	87	Core - The Balance of Payments Basic balance of payments accounts Description of debits and credits Capital inflows and outflows Entries for specified international transactions Why balance of payments "always balances" Basic balance Definition Why a useful concept Importance of short-term capital flows	I/A-H-
456	88	Core - International Adjustment Process Gold parity Meaning Compute exchange rates given currency prices in gold "Classical" gold standard Requirements Reasons exchange rates fluctuated in narrow range Mercantilist view of gold Hume's specie-flow mechanism As a method of adjustment Impact of gold loss on money supply Classical view of economic adjustment process	I/A-H-

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Block Number	Segment I.D. Number	Segment Description	*Media Strate
458	89	Core - International Adjustment Process Impact of change in money supply on an under-employed economy Reasons why wages and prices are "sticky downward" Effect of changed incomes on demand for imports Numerical problem Differences between Hume's theory and the actual adjustment process which occurred	I/A-H-M
460	90	Core - The International Adjustment Process Problems with classical gold exchange standard Today's gold exchange standard Differences between pre- and post-1914 adjustment Benefits from today's gold exchange system Costs of today's gold exchange system Determinants of the levels of exports and imports Effect of changes in money supply and government expenditures on the balance of trade	I/A-H-M
462	91	Core - Correcting Payments Disequilibrium Currency depreciation and appreciation Meaning of Effect on exports and imports and balance of payments Effect on domestic economy Tariffs, quotas and export subsidies Meaning of Effects on exports, imports, and balance of trade Effect on domestic economy	I/A-H-M
464	92	Core - Flexible Exchange Rates Flexible exchange rate system Description Supply and demand for foreign exchange Equilibrium and stability Benefits and costs of a flexible exchange rate system	I/A-H-M

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Block Number	Segment I.D. Number	Segment Description	*Media Strateg
466	93	Core - Welfare Implications of Selected Policy Variables Impact of tariff on a particular good Merits of tariff vs. quota Merits of tariffs vs. export subsidies Revenue tariff, pro and con Use of tariffs to correct domestic unemployment	I/A-H-M-
468	94	Core - Policy Applications and Problems Effect of fiscal and monetary policies on national income and the balance of payments Problems in identifying policy mixes to counter specified domestic and payments difficulties	I/A-H-M-
470	95	Test - Post test on segments 86 through 94	G-I/H-M
472	96	Counsel - Counsel and prescribe	G-I/P
474		Group Discussions	G/P-D
476	96R-1	Remediations - Remedial learning time (variable in length) and retest.	Mixed

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APPENDIX E

Excerpt from List of Summarized Objectives

SEGMENT 51

3125	Definition of utility
3122	Selection of a graph illustrating total utility
3140	Definition of total utility
3121	Identification of the relationship of total utility to quantity consumed, given a graph
3120	Definition of marginal utility
3113	Relationship between demand and marginal utility
3119	Explanation of why the marginal utility curve is downward sloping
3116	Identification of the marginal utility curve, given a total utility schedule
3117	Identification of the shapes of the total utility and marginal utility functions, given a description
3118	Correlation of MU and TU graphs

SEGMENT 52

3190	Explanation of the paradox of value
3110	Identification of the "consumer utility maximization" equation
3111	Conditions for consumer equilibrium, given fixed income and prices
3112	Selection of the consumer equilibrium, given the marginal utilities and other data for two goods

SEGMENT 53

3345 Identification of the "price elasticity of demand" formula

3346 Definition of price elasticity of demand

3344 Calculation of the price elasticity of demand for a given point on a curve, given data

3342 Identification of a graph representing perfect inelasticity

3338 Consumer behavior regarding quantity demanded, when prices decrease for a perfectly inelastic good

3341 Explanation of the elastic, unitary and inelastic ranges on a given linear demand curve

3309 Identification of the elasticity points, given a demand curve and its corresponding total revenue curve

3339 Effect on total revenue when the quantity purchased increases for a good having unitary elastic demand

SEGMENT 54

3333 Definition of income elasticity of demand

3330 Selection of the "income elasticity of demand" formula

3334 Identification of the economic analysis - static

3335 Identification of the economic analysis - dynamic

3331 Significance of tests or incomes in demand analysis

3310 Definition of a normal good

3311 Definition of an inferior good

3328 Definition of the substitution effect

3329 Definition of a complementary good

SEGMENT 55

3623	Definition of "short run"
3621	Description of fixed costs
3622	Definition of variable costs for a firm
3615	Definition of average fixed cost
3614	Definition of average total cost in the short run
3616	Definition of average variable cost
3618	Relationship between "fixed cost" and the "short run"
3619	Component of variable cost and fixed cost
3620	Relationship between variable cost and production
3617	Characteristics of total cost
3613	Selection of a total cost curve for a given total cost function

SEGMENT 56

3612 Definition of marginal cost

3609 Derivation of marginal costs, with reference to variable costs

3610 Determinants of marginal cost

3611 Derivation of marginal cost with regard to total cost

3608 Calculation of the marginal cost given a firm's output and total cost

3607 Relationships between total cost, average total cost, marginal cost, total variable cost, average variable cost, total fixed cost, and average fixed cost

SEGMENT 57

3656 Identification of ATC, AVC and MC for specific levels of output, given a graphical statement

3652 Identification of the relationships between the firm's costs and receipts, given a market price for the product less than AVC and other data

3653 Significance of a situation, given a market price between the minima of ATC and AVC and other data

3654 Significance of a situation, given a market price greater than minimum ATC and other data

3630 Identification of the quantity outputs to be supplied at low and high prices, given data

3655 Completion of TR, TC, TP and MC and determination of whether a firm will supply the market with goods, given data

3651 Identification of the condition underlying the willingness to supply output to the market

3650 Identification of a firm's short-run supply function

SEGMENT 58

3801	Definition of the long run
3802	Comparison of component costs in the long and short runs
3804	Definition of the long-run average total cost curve
3821	Characteristics of "economics of scale" for a firm
3822	Identification of scale economies
3809	Meaning of expansion of output for the individual firm in the long run
3807	Identification of the meaning of a shift in ATC, given an example
3806	Identification of the long-run average total cost curve

SEGMENT 59

3816	Definition and/or effect of external economies
3819	Definition and/or effects of external diseconomies
3820	Description of and/or the effect of internal diseconomies
3817	Definition and/or effect of internal economies
3818	Identification of the role of economic factors in production
3813	Shape of a long-run average cost curve
3824	Factors which cause movements along and shifts of the long-run average total cost curve

SEGMENT 60

3826 Effect of a significant change in industry demand for a product on: a firm's short-run supply, long-run supply, and eventual industry equilibrium price

3825 Effect of a significant change in demand for a product over a time period long enough to allow for scale adjustments, after initial short-run discoveries have occurred

3827 Identification of the corresponding readjustments in production, given a changing industry supply and demand equilibrium over a time period long enough to permit readjustments in the production process

SEGMENT 61/ 62

3904	Characteristics of a purely competitive market
3906	Determinant of industry demand in a purely competitive market
3915	Derivation of industry's supply
3908	Description of industry equilibrium in a purely competitive market
3907	Firm demand-industry demand relationship at the existing industry equilibrium price
3909	Defintion of marginal revenue
3903	Graphical or verbal identification or marginal revenue
3902	Identification of average revenue given price and quantity information
3910	Definition of average revenue
3911	Relationship between the firm demand curve and the marginal revenue curve

SEGMENT 63

3902 Description of entrepreneurial behavior

3912 Identification of the profit maximizing output, given information on marginal cost, marginal revenue and output of an invidividual firm in a competitive market

3913 Selection of the short-run profit maximizing (or loss minimizing) output, given schedules relating total receipts and total costs to levels of output

3914 Selection of the short-run profit maximizing (or loss minimizing) output, given graphical illustrations of costs and revenue relationships for an individual firm in a short-run competitive market situation

3916 Identification of a firm-industry equilibrium situation, given graphical illustrations of industry demand and supply relationships and a competitive firm's revenue and cost functions

3917 Description of short-run firm equilibrium

3918 Consequences of a change in industry demand, in the short run, in terms of output for maximizing profit in a competitive market situation

3920 Determinant of equilibrium in the long run

3921 How a firm may maximize profit in the long run

SEGMENT 64

3922 Long-run criteria for entry and exit of a firm in an industry

3923 Signficance of marginal cost intersecting the marginal revenue curve at a point above and to the right of the marginal-cost/average-cost intersection

3924 Effect of a shift of industry demand in the long run on the equilibrating situation

3925 Dynamics of long-run equilibrium adjustment in a pure competition

3926 Sequence of entry and exit in a purely competitive industry in the long run

SEGMENT 65

3947 Characterization of monopoly

3948 Description of natural monopoly

3949 Barriers to entry in a monopoly situation

3937 Derivation of the supply curve of a monopolist

3932 Relationship between industry and firm demand in the monopolistic market

3935 Relationship of the marginal revenue curve to the demand (average revenue) curve

3933 Relationship of the elasticity of a demand curve to firm decision-making in a monopolistic market situation

3936 Derivation of the marginal revenue curve confronting a monopolist, given $P = a-bq$ as the average revenue curve

SEGMENT 66

3939 Operational definition of the marginal revenue/marginal cost intercept

3928 Graphical identification of short-run profit maximization and other parts in a monopoly situation

3940 Effect of technolgoical change on product production in a monopolistic market

3941 Effect of shifts in demand on price and quantity output of a monopolistic firm

3942 Short-run readjustments for a monopolistic firm

3943 Average cost in long-run equilibrium in monopolistic and in competitive industries

3944 Comparison of price and quantity output for an industry under conditions of monopolistic and competitive markets in the long run

SEGMENT 67

3950 Description of a monopolistically competitive market

3951 Characteristics of a monopolistic competition

3952 Characteristics of firm elasticity of demand in a monopolistically competitive market

3953 Identification of a monopolistically competitive firm's subjective view of the relationship between its own demand and industry demand

3956 Rationale for price competition in monopolistically competitive markets

3957 Rationale for product variation in a monoplistically competitive market

3958 Rationale for advertising costs in monopolistic competition

3959 Determinants of variations in the supply and demand curves for a monoplistically competitive firm

3954 Characteristics of cost curves (supply curves) in a monopolistically competitive market

3960 Effect of price competition on the industry and on an individual firm's supply and demand curves

3961 Effect of product variation on the industry and on an individual firm's supply and demand curves

3962 Effect of changes in selling costs on the industry and on the individual firm's supply and demand curves, in a monopolistically competitive market

SEGMENT 68

3964 Short-run equilibrium in a monopolistically competitive industry

3965 Long-run equilibrium in a monopolistically competitive industry

3963 Rationale and significance of the "tangency solution" of a monopolistically competitive market equilibrium

SEGMENT 69

3966 Relative price equilibrium points, in the long run, for an industry under monopolistic, competitive, and monopolistically competitive market situations

3967 Relative quantity equilibria for an industry under monopolistic, purely competitive and monopolistically competitive market situations, where identical cost structures prevail

3968 Comparison of long-run profit situations at equilibrium for an industry under the three market situations (3967)

3969 Advantages and disadvantages of a monopolistically competitive market

SEGMENT 70

3970 Definition of oligopoly as a market structure

3971 Demand interdependence in an oligopolistic market

3972 Price behavior in oligopoly

3973 Product variance behavior in oligopoly

3974 Oligopoly behavior with respect to quantity variation

3975 Why sales competition (advertising) is a type of oligopoly behavior

3976 Oligopolistic market supply in both short-run and long-run market periods

3977 Relationship between firm and industry demand in an oligopolistic market

3978 Rationale for indeterminate equilibrium within an oligopolistic market structure

3979 Collusion in an oligopolistic market structure

3980 Price leadership in an oligopolistic market structure

3981 Rationale for firm behavior in an oligopolistic market structure

7/ - SEGMENT 74

4001	Definition of marginal physical product
4002	Relationship between the marginal physical productivity and diminishing returns
4004	Graphical illustration for the marginal physical product curve of a factor input which illustrates its relationship to dimishing returns
4003	Primary determinants underlying demand for a factor input
4006	Explanation of the downward sloping factor demand curve
4007	Definition of the marginal revenue of a factor input
4008	Definition of derived demand
4009	Demand for a factor as a demand schedule

SEGMENT 75

4010 Causes of shifts in demand for input of a factor

4011 Determinants of elasticity of demand for factor inputs

4012 Substitution effect for factor inputs

4013 "Complementarity effect" for factor inputs

4014 Effect of changes in the price of factor inputs on the demand for the factor inputs

4015 Definition of market demand for any factor input

SEGMENT 76

4016 Determinants of the supply of labor

4017 Determinants of the supply of capital

4018 Characteristics of the supply of land and determinants of its value

4019 Basic assumption underlying the marginal productivity theory

4021 Definition of marginal factor cost

4020 Definition of average factor cost

4022 Optimum use of single factor input

4023 Determination of the income receipts of the factors of production

4024 When optimum use of all factor inputs occurs, under conditions of profit maximization behavior

SEGMENT 77

4406	Derivation of the demand for labor
4407	Relationship between the elasticity of demand for labor and for the commodity produced
4405	Basis of a firm's demand for labor
4403	Sources of an industry's demand for labor
4404	Description of the aggregate demand for labor employed within the economy
4401	Graphical relationship, under competitive conditions, between the firm's, industry's, and economy's demand for labor
4400	Explanation of the equilibrium of supply and demand in the labor market

SEGMENT 78

4801 Assumptions underlying the purely competitive labor market

4802 Basis for labor market imperfections

4803 Identification of the non-competing groups within the labor market

4804 Rationale for wage differentials existing within the labor market

4805 Differences between unnatural and natural impediments within the labor market

4806 Natural impediments in the labor market

4807 Unnatural impediments within the labor market

4808 Unnatural impediments imposed upon the labor market by management and management organizations in an attempt to influence wage rate determination

4809 Management's rationale for lockouts

4810 Management's rationale in the formation of company unions

4811 Rationale underlying discriminatory discharges of workers by employers

4812 Rationale underyling blacklisting practices as practiced by employers

4813 Graphical illustration of the wage rate effects desired by management in their attempts to impose unnatural impediments into the labor market

4814 Rationale for restrictive union membership requirements

4815 Union's rationale underlying above equilibrium wage rates secured through collective bargaining arrangements with managements

4816 Effect of restrictive union membership practices

4820 Effect of a situation where a union imposes restrictive membership requirements, and has a collective bargaining agreement with management at wages above the equilibrium wage rate

SEGMENT 78
(Continued)

4817 Graphical effects of restrictive union membership practices

4824 Effect of a situation where the labor unions can restrict the quantity of labor supply, and where there are natural impediments to labor mobility

4822 Characteristics of legislation sought by management

4823 Characteristics of legislation sought by labor unions

4821 Rationale underlying the lobbying efforts of management and organized labor

SEGMENT 79

4835 Operational definition of "rent"

4836 Operational definition of "land"

4833 Operational definition of "wages and salaries"

4834 Operational definition of "labor"

4832 Operational definition of "capital"

4830 Operational definition of "interest"

4831 Operational definition of "profits"

4

4846 Operational definition of "entrepreneur"

4838 Definition of "functional distribution of aggregate income"

4837 Significant factors underlying the functional distribution of GNP

4839 Recent trend in the functional distribution of income (e.g., the past twenty years), in the U.S.

4841 Operational definition of "size distribution of aggregate income"

4843 Significant factors underlying unequal size distribution of GNP

4842 Factors which tend to ameliorate in inequalities in the size distribution of income

4845 Methods of analyzing the distribution of GNP

SEGMENT 86

5046 Meaning of comparative advantage

5047 Identification of comparative advantage, given a table of outputs per unit of labor for two products in two different nations

5048 Identification of comparative advantage in terms of ratio of exchange and of the good to be exported, given a situation

5049 Identification of the consumption possibilities curve after engaging in international trade, given a situation

5050 Explanation of the advantage of international trade in a world economy

5051 Benefits derived from international lending

5052 Costs of international borrowing or lending

5053 Description of how prices of the internationally traded goods and the factors specific to them change with the introduction of international trade, given an example

5054 Effect of opening free trade on the prices of goods and the factors of production

SEGMENT 87

5099 Identification of the three accounts in the balance of payments

5097 Meaning of capital outflow and capital inflow

5025 Description of debits and/or credits in our balance of international payments accounts

5026 Identification of an entry in the U.S. balance of payments which is not a credit (debit)

5027 How a particular transaction involving two entries would appear in the balance of payments accounts

5028 Sense in which the balance of payments will always balance

5029 Definition of the basic balance

5098 Reason why short-term capital flows are recorded separately

5030 Why the basic balance of payments deficit (or surplus) is a useful concept

SEGMENT 88

5004 Description of the economic thinking of the "mercantilists"

5001 Requirements a nation must meet in order to be on the "classical" pre-1914 gold standard

5002 Identification of the price of a currency in terms of the dollar, given an example

5003 Reason why the price of one currency in terms of another could fluctuate within their narrow limits under the pre-1914 gold standard

5005 Impact of a loss (or gain) of one unit of gold on the money supply of a country, subscribing to the pre-1914 gold standard, when that country's central bank holds a fixed fraction of one unit of gold for every X units of the money supply

5096 Summary of an important conclusion of classical economists

5095 International adjustment process as presented in the Hume specie flow mechanism

5006 Description of Hume's specie flow mechanism

SEGMENT 89

5007 How demand for imports would change if incomes were increased

5008 Impact of a change in income on imports, given an example

5010 Initial impact of a change in the money supply in an underemployed economy

5011 Reason why prices and wages don't fall immediately after a reduction of the money supply or a reduction of government expenditures, or why falling prices and wages are usually accompanied by some unemployment

5013 Principle difference between Hume's specie flow mechanism and the way adjustment actually took place under the pre-1914 gold standard

SEGMENT 90

5009 How the volume of a nation's exports and imports depends on the price and income levels of that nation and her trading partners

5012 Description of changes which occur in a country's balance of trade in response to a reduction (increase) in the money supply

5014 Why the gold exchange standard was a costly way to attain international equilibrium

5015 Major characteristics of today's gold exchange standard

5016 Description of the adjustment of payments imbalances under the post-1914 gold exchange standard

5017 Major benefits derived from today's gold exchange system

5018 Major costs imposed by today's gold exchange standard

5019 Main purpose of the International Monetary Fund (IMF)

SEGMENT 91

5032 Definition of "depreciate" and "appreciate"

5031 Distinction between an import tariff and an import quota

5034 Impact on expenditure patterns of a subsidy on all exports

5033 Impact on domestic spending patterns of a tariff on imports

5038 Impact on U.S. income of a U.S. subsidy of all exports and a tariff on all imports or of a depreciation of the dollar

5037 Impact on the balance of payments of depreciation of a country's currency or a subsidy on all exports and a tariff on all imports

5035 Effect of depreciation of the dollar on U.S. exports and on the income of U.S. exporters

5036 How depreciation of the dollar would affect U.S. imports and the income of producers of substitutes for U.S. imports

5039 Effect on the balance of payments and on employment of a reduction in tariffs and quotas on imports and of reduction in subsidies on exports, or the effect of appreciation of currency.

SEGMENT 92

5020	Description of a "flexible exchange rate system"
5021	Relationship between the supply and demand for a country's currency, the supply and demand of foreign exchange in the country, and the supply and demand for exports and imports
5022	Why, under a flexible exchange system, the price of foreign exchange must always converge to its equilibrium rate (where supply equals demand)
5023	Major costs which would be imposed by a flexible exchange rate system
5024	Major benefits of flexible exchange rates

SEGMENT 93

5055 Impact of a tariff on the import of a particular good

5056 Statement which indicates which is to be preferred -- a tariff or quota, and why

5057 Reasons why a subsidy on the output of a particular industry is better than a tariff designed for the sole purpose of protecting that same industry

5058 Use(s) of tariff for revenue

5059 Use(s) of tariffs to eliminate unemployment

SEGMENT 94

5040 Impact of a decrease in government expenditure, an increase in taxation or a contraction of the money supply on national income and the balance of payments

5041 Impact of an increase in government expenditure, a decrease in the level of taxation, or expansion of the money supply on national income and the balance of payments

5042 Policy tools to combat both a balance of payments deficit and over-full employment which is causing inflation

5043 Policies to combat both a balance of payments surplus and over-full employment

5044 Policies to combat a balance of payments deficit and unemployment

5045 Policies to combat a balance of payments surplus and unemployment

APPENDIX F

Excerpt from TR-5.31,

"Preliminary Tryouts: Economics Course"

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Preliminary Tryouts

The purpose of this document is to describe the preliminary tryouts of materials, including the materials revision process. Discussed in detail are the characteristics of the students involved in the trials, the gauging of each one's reactions to the materials, the analysis of errors, and the preparation of revisions. Samples of forms used in the revision process, as well as examples of actual revisions, have been incorporated in this document. The preliminary tryouts are one part of materials validation and provide the first indication that students can and do learn from the materials, as well as an indication of possible problem areas.

A. Target Population/Student Population

Students participating in the preliminary tryouts were selected on the basis of their similarity to the Academy midshipmen. The following criteria guided their selection:

1. Males, ages 19-23
2. Enrollment in college - preferably juniors
3. Major - preferably engineering
4. No previous college economics courses
5. College Board scores, both Verbal and Math, similar to those of the Academy midshipmen
6. Willingness to complete the entire course, including tests

The young men chosen for the tryouts are all between the ages of 19 and 23. Each student is currently attending one of the three local universities; namely, George Washington University, Georgetown University, and American University. On the average, they are juniors, and their majors include engineering, psychology and English. Like the Academy midshipmen, none has had a college course in economics, and their average SAT Verbal and Math scores are similar to the mean SAT Verbal and Math scores of the midshipmen. As evidenced by their continued, conscientious efforts and the fact that over half of them have completed forty segments, the students appear willing to complete the course.

B. The Tryouts

1. Orientation

The first session for each student consisted of orientation to the course and to the self-instructional materials. Self-instructional packages were displayed and explanations of the various parts of the S-I material were given, such as the rationale for including problems in the materials (see Figure 1) and for giving a self-test (segment test) at the end of each segment (see Figure 2).

Copies of McConnell, Samuelson and Bach[1] were displayed and explanation of their use in the course was given. Figure 3 shows two practice problems and indicates how they are directed to related texts for additional explanation, if difficulty with the material is encountered. In preliminary testing requests for further explanation were documented and considered in materials revisions.

An example of how related texts are referred to in prescriptions is shown in Figure 4. Note that these prescriptions are part of the segment self-test. As in the case of the practice problems, if a student in the preliminary tryouts stated that he needed help (such as from the references specified) it was documented for use in planning revisions.

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[1] McConnell, Campbell R. Economics, New York: McGraw-Hill Book Co., 1966.
Samuelson, Paul A. Economics, New York: McGraw-Hill Book Co., 1967.
Bach, George L. Economics, Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1968.

Now recall the elements of this equation by answering the questions below. First set your Dymedia at "V."

1. In the consumption function $C=C_a+bY$, the symbol bY stands for:

   a. The intercept with the Y axis
   b. Autonomous consumption
   c. Induced consumption
   d. Total consumption

2. In the consumption function $C=C_a+bY$, the symbol C_a stands for:

   a. Consumption resulting from changes in income
   b. Autonomous consumption
   c. Total consumption
   d. The intercept on the x axis

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Figure 1. Example of a practice problem sequence included in the instructional materials for an objective.

Segment Test
(23)

Below are several questions based on the material you have just studied. You should not need more than about ten (10) minutes for this test. Set your Dymedia to setting J and be sure to insert a record card. You will not be graded for your performance on this test; however, you must turn in your Dymedia card to your instructor because (1) your performance will be used by materials design personnel as the basis for improving the learning materials in this segment and (2) your instructor may use the information as the basis for recommending future learning materials. After you have completed the test, please fill in the Student Critique Sheet and turn it in to your instructor along with your Dymedia cards.

Dymedia to J

1. Which of the following is equal to MPS?

   a. Difference between consumption and savings divided by the change in income, or $\frac{\Delta C - \Delta S}{\Delta Y}$
   b. Slope of the consumption function, or $\Delta C/\Delta Y$
   c. Slope of the savings function, or $\Delta S/\Delta Y$
   d. Change in the slope of the savings function, or $\Delta\Delta S/\Delta Y$

2. Which of the following is equal to MPC?

   a. Slope of the savings function, or $^{\Delta S}/_{\Delta Y}$
   b. Slope of the consumption function, or $^{\Delta C}/_{\Delta Y}$
   c. Difference between consumption and savings over the change in income, or $\frac{\Delta C - \Delta S}{\Delta Y}$
   d. Change in the slope of the MPC function, or $^{\Delta\Delta C}/_{\Delta Y}$

3. - - - - -

Figure 2. Example of the type of instructions that precede the test items in a segment self-test.

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Be certain you can identify savings. Check yourself on the following questions.

3. The residual between disposable income received and money spent on final goods and services is a definition of which of the following?

   a. Transfer payments
   b. Savings
   c. Total assets
   d. Taxes

4. Which of the following correctly define(s) savings?

   a. S=Y-C
   b. Leftover disposable income after consumption
   c. Disposable income not consumed
   d. All of the above

If your understanding of "savings" is still fuzzy, reread the above materials. For further explanation, see McConnell, 119.

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Figure 3. Example of how students are directed to related texts if they encounter difficulty with practice problems and want further explanation.

Segment Test 22

Prescription

If you missed any of the questions, it is strongly recommended that you review the material for the appropriate objective in this segment, and then check the references given below before you attempt further work in this course.

Question	Contents	Reference
1	Definition of consumption	Seg. 19, Obj. 1704 Seg. 22, Obj. 1510 McConnell, 165-6
2	Definition of savings	Obj. 1504 McConnell, 119
3	Identification of a savings function graph	Obj. 1594 McConnell, 220-2 Samuelson, 200-03
4	- - - - -	

Figure 4. Example of how students are directed to related texts if they encounter difficulty in the segment self-test.

Students were then shown the Dymedia Response Board and after some instruction proceeded to use it by attempting to answer a problem in the S-I material. This demonstrated to the student how he receives immediate feedback when answering questions. Subjects then filled out the Dymedia cards. They were cautioned to be sure to record the time it took to go through a segment, and they were instructed to work at a steady pace. These records of time needed to complete a segment have served as the basis for a fair estimate of the learning time required for each package.

Following the presentation of the methodology of using the self-instructional materials came an explanation of the use and importance of the student critique sheets, and the rationale for pre and post tests.

Throughout the orientation subjects were encouraged to ask questions. They gave evidence of enthusiasm by their impatience to get on with the pretest.

This format for orientation became the prototype for the Academy orientation.

2. General Procedures

Each student learns the segments in sequence. This includes enrichment as well as core segments. Whenever segments are available on audio tape with workbook, some students use this medium. Each proceeds at his own pace, and in general the following procedures are used.

The student receives an instructional package, the Student Critique Sheet, and the Dymedia Response Board and cards. He proceeds to an appointed classroom, studies the materials, and takes the Segment Test. Next, he fills out the critique sheet, and finally, he returns the instructional materials, Dymedia cards and critique sheet to the interviewer. Before continuing with the next segment, he is debriefed by a staff member.

3. The Debriefing Interview

The purposes of the debriefing interview are:

a. To determine the general reaction to the materials,
b. To determine exactly what a student means by his comments,
c. To discover the student's reasoning when he makes an error,

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d. To counsel the student concerning his progress and to prescribe remedial measures,

e. To obtain information which can serve as a guide for revisions.

Remarks made by students during the interview are recorded on the student critique sheet. For example, when a student has rated a segment as very good, it is essential to find out what in this particular segment made it more appealing to him. Comments such as, "The graphs helped," or "I liked having all the problems in the segment related to one situation," give clues for improving other segments. If a student has remarked that an explanation is not clear, then the interviewer questions him in an effort to determine why the explanation is not clear. It sometimes happens that a poorly constructed sentence is the cause of the ambiguity. The Student Critique Sheet points out problems, and the interviewer seeks to find out the reasons for the problems.

The interview also serves as a time for counseling and prescription. After the student has completed each unit or post test, his work is checked by the interviewer who discusses with him his test score, his strengths and weaknesses, making recommendations for remedial work. A student whose errors indicate that he has not mastered the objectives for a segment[2] is asked to rework that segment. Whenever possible, the segment is given in an alternate medium. The prescription may consist of advising the student to continue with the next segment. Should that be a segment devoted to testing, then the student is encouraged to spend an hour reviewing those segments included in the test.

To reiterate, in the student tryouts each subject studies the materials in sequence (as do the midshipmen), takes the test and criticizes the materials, frequently offering suggestions for improvement. In an interview following each segment he is encouraged to explain in detail his critique, and any additional comments are noted. The comments and suggestions for each segment are collected and form the basis for any revisions which may be made.

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[2] A segment requires approximately one hour of learning time and consists of material pertaining to a group of related objectives. A segment is usually one part of a larger topic.

C. The Revision Process

Revisions are made in order to facilitate the learning of objectives and to improve the items by which the learning is tested. Although the number of students participating in the preliminary trials is small, it cannot be assumed that every error automatically requires a revision, but it can be assumed that every error requires that the materials be scrutinized to determine whether revision is indeed necessary, and if so, how extensive it should be.

After six students have completed a segment, revision of the material is begun. There are five steps in the revision process.[3]

The first step in the materials revision process is to record errors on Form B, the Segment Record, (Appendix A). Errors in both the learning problems and self-test, along with the correct answer are tallied. In order to identify those objectives which have not been learned, the identifying number of each objective is noted. Whenever errors are recorded for an objective, in both the learning and the self-test columns, that objective is flagged for immediate attention.

From the sample Form B for Segment 9 (Appendix A), it is apparent that five objectives have been flagged (boxed and labeled A, B, C, etc.) indicating that students missed both the problems in the learning materials and the related questions in the self-test. Form B for Segment 9 also reveals according to the error tallies that students have not learned other objectives; whereas, Form B for Segment 23 shows only three possible areas of revision. Students find some materials more difficult than others.

Step 2 of the revision process consists of reviewing the Student Critique sheets (see Appendix B), including the interviewer's remarks, to ascertain as precisely as possible the causes of the difficulties experienced. In the case of Objective 0833, Segment 9, students indicated that the explanation was not clear and that solving more problems might help in making the principles clearer. One student suggested underlining a word to emphasize it. In each case, the comments are noted on the Summary Sheet for Suggested Revisions (Appendix C).

In step 3, the content for each objective and test item which has caused some difficulty is reviewed in an

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[3] The revision of the audio tapes follows essentially the same steps as those in the revision of the self-instructional packages. However, in general, the former revisions are made after two students have tried out the tapes.

effort to determine the validity of the student reaction and also what revisions, if any, are necessary. Reading the material for Objective 0833, Segment 9, revealed that the explanation contained contradictory statements which were indeed confusing. Moreover, the main point of the objective which was crucial to answering correctly both problems and self-test items was not emphasized. Both these facts were included on the Suggested Revisions Sheet. Sometimes the review of content indicates no revision is necessary, and this, too, is noted on the Revision Sheet.

Step 4 consists of making changes in light of the suggested revisions. Whenever a major revision, such as the rewriting of content or the addition of problems is necessary, the Summary of Suggested Revisions Sheet is given to an economist who makes the improvements. To date the students have experienced little difficulty with the self-instructional materials, and few revisions have been required. In the case of the above-mentioned Objective 0833 of Segment 9, the summary of the objective was enclosed in a box (Appendix D) and an economist rewrote the explanation to emphasize the unpredictability of the situation. For Objective 0835 a less complicated problem was inserted as #26, and 26 became 27. In some instances, the economist may decide to change the distractors in a question. Minor revisions such as underlining a word or reconstructing a clause in a sentence are made by ETC personnel.

The final step in the revision process is trying out the revision. Generally, one or two students take the revised segment, and then, the same process of critiquing and interviewing is followed. As yet, there has been no need for a second revision; however, should the trials reveal that students still do not learn effectively from the revision, there would be additional revisions, as time permits. The revised materials are then duplicated for the Academy.

D. Results

To date the students involved in the preliminary tryouts have indicated that they find the instructional materials very good. They like the format and the idea of self-pacing. The logical organization of the material has received most favorable commendations. Moreover, the students claim this is a key factor in their ability to understand and to remember the objectives. The subjects continue to be amazed at how well they remember definitions and principles without making a concentrated effort to memorize. According to these students the problems accompanying each objective enable them immediately to apply

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what they have learned and this immediate application strengthens learning. The use of Dymedia to give immediate feedback concerning the correctness of responses continues to evoke enthusiasm. The self-test challenges them, and being able to discover specifically what has not been learned well to that point affords an opportunity to restudy specifically these points. Students have remarked that this is an efficient way to learn.

The preliminary tryouts by students similar to the Academy midshipmen not only have provided information necessary for revision but also have proven that students do learn economics by studying these materials.

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APPENDICES

TR-5.31

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*= Correct Answer Number **Segment Record - Form B** O = same person as already tallied

Segment #: 9 Key: Learning Key: Self-test

cm#	A	B	C	D		A	B	C	D	Remarks
1					0831 1.	11	*	11	000	C
2					2.					
3					3.					
4					4.					
5					0830 5.	1	*	0		B
6					0832 6.		1	*		D
7					7.					
0827 8 A	1		*		0828 8.			*	1	
9					9.					
10					0833 10.			1	*	E
0836 11	1		*	1	0825 11.		1	*	0	
0836 12		*		1	12.					
0899 13	1	0	0	*	0824 13.			1	*	
08 14	*		1		0827 14.	*	11	00	0	A
0830 15 B	*	1			15.					
0830 16		*	1		16.					
17					17.					
0831 18 C		*	1111	0	18.					
0831 19	1	*		0	19.					
20					20.					
0832 21 D			1	*	21.					
0833 22 E	~~1111~~	000	*	0	22.					
0833 23			*	1111	23.					
24					24.					
25					25.					
08 26	*		111		26.					
27					27.					
28					28.					

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* = Correct Answer Segment Record - FORM B O = same person as already tallied

Segment # 23 Key: Learning Key: Self-test

Item#	A	B	C	D	A	B	C	D	Remark
1					1.				
2					1532 2. 1	*			
3					3.				
4					4.				
5					5.				
6					1550 6. 1	*			
7					7.				
8					8.				
9					9.				
10					10.				
1573 11	*	1	0	0	11.				
12					12.				
13					13.				
14					14.				
15					15.				
16					16.				
17					17.				
18					18.				
19					19.				
20					20.				
21					21.				
22					22.				
23					23.				
24					24.				
25					25.				
26					26.				
27					27.				
28					28.				
29									

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Appendix B

Student Critique Sheet

Segment Materials and Segment Tests

Segment Number #9

Student Number #6 Bill [illegible]

Content	Yes	No or None	Questions, Comments, Suggestions, Page Numbers, Etc.
1. Were the general instructions clear?	✓		
2. Were you aware at all times of what you were to learn?	✓		
3. Which explanations were too wordy?		✓	
4. What word meanings, concepts, mathematical relationships, or information should you have had as prerequisites to learning this material?		✓	
5. Which directions for working problems were ambiguous?		✓	
6. For which objectives do you need more problems to solve?	0835		19.41 4.2 - #22 & #23 - more needed to get pattern or explanation
7. Was it necessary to memorize much information in order to complete the segment successfully?		✓	
8. What explanations or problems are unnecessary?		→	maybe not so much on [illegible] example
9. What explanations were ambiguous or difficult to understand?	[illegible]		
10. For which objectives was it necessary to study the additional references?		✓	

[illegible] plan
22 23
42 16 .37 missed .05.

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		Yes	No or None	Questions, Comments, Suggestions, Page Numbers, Etc.
1.	Was the learning organized?	✓		
12.	Did the learning flow in logical sequence?	✓		
13.	What diagrams, tables or charts were difficult to read?		✓	
14.	What typos did you notice?		✓	
15.	Where you able to complete the learning segment in 45 minutes?	✓		
	SEGMENT TEST			
1.	Which directions were not clear or were inadequate?		✓	
2.	Which questions failed to state exactly what was required?		✓	
3.	For which questions did you "psych out" the answer?		✓	
4.	For which questions did you guess the answer?		✓	
5.	For which questions were you able to determine the answers from information given in another question?		✓	
6.	For which questions did you find two correct alternatives?	#11		answer b to #11 isn't right but it's so common a phrase that it sounds right.
7.	In which questions did the format cause you difficulty?		✓	
8.	In which questions were the graphs, tables or diagrams difficult to read?		✓	
9.	Which items tested you on content not included in this segment?		✓	

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	Yes	No or None	Questions, Comments, Suggestions, Page Numbers, Etc.
. Which answers did you change? Why did you change?	#11		momentarily fooled by answer 6
11. Did your performance on the segment test indicate that you had learned?	✓		

12. How would you rate the segment you have just finished? Compare it with other segments you have learned. Check the general category. The descriptive phrases are there to help you decide on a rating.

Poor	Fair	Good	[✓ Very Good]	Excellent
I can't learn from this. Boring Turns me off Too much work	Boring in places, but generally ok. Sometimes it turns me off. Too much reading, but I learn	It's neither better nor worse than the others. Acceptable; so-so Takes a lot of time, but I learn.	An improvement over the usual Turns me on sometimes It requires a lot of reading but I learn more than from a text book. It helps me to know that I got the answers Not so boring	Really turns me on! Learn a lot with not too much troub Would like all my courses like this Not at all boring

Appendix D

Student Critique Sheet

Segment Materials and Segment Tests

Segment Number 23

Student Number 3

Content	Yes	No or None	Questions, Comments, Suggestion Page Numbers, Etc.
1. Were the general instructions clear?	✓		
2. Were you aware at all times of what you were to learn?	✓		
3. Which explanations were too wordy?		✓	
4. What word meanings, concepts, mathematical relationships, or information should you have had as prerequisites to learning this material?		✓	
5. Which directions for working problems were ambiguous?		✓	
6. For which objectives do you need more problems to solve?		✓	
7. Was it necessary to memorize much information in order to complete the segment successfully?		✓	
8. What explanations or problems are unnecessary?		✓	
9. What explanations were ambiguous or difficult to understand?		✓	
10. For which objectives was it necessary to study the additional references?		✓	

	Yes	No or None	Questions, Comments, Suggestions, Page Numbers, Etc.
1. Was the learning organized?	✓		
12. Did the learning flow in logical sequence?	✓		
13. What diagrams, tables or charts were difficult to read?		✓	
14. What typos did you notice?		✓	
15. Where you able to complete the learning segment in 45 minutes?	✓		
SEGMENT TEST			
1. Which directions were not clear or were inadequate?		✓	
2. Which questions failed to state exactly what was required?		✓	
. For which questions did you "psych out" the answer?		✓	
4. For which questions did you guess the answer?		✓	
5. For which questions were you able to determine the answers from information given in another question?		✓	
6. For which questions did you find two correct alternatives?		✓	
7. In which questions did the format cause you difficulty?		✓	
8. In which questions were the graphs, tables or diagrams difficult to read?		✓	
9. Which items tested you on content not included in this segment?		✓	

	Yes	No or None	Questions, Comments, Suggestions, Page Numbers, Etc.
Which answers did you change?		✓	
Why did you change?			
11. Did your performance on the segment test indicate that you had learned?	✓		

12. How would you rate the segment you have just finished? Compare it with other segments you have learned. Check the general category. The descriptive phrases are there to help you decide on a rating.

Poor	Fair	Good	Very Good	✓ Excellent
I can't learn from this. Boring Turns me off Too much work	Boring in places, but generally ok. Sometimes it turns me off. Too much reading, but I learn	It's neither better nor worse than the others. Acceptable; so-so Takes a lot of time, but I learn.	An improvement over the usual Turns me on sometimes It requires a lot of reading but I learn more than from a text book. It helps me to know that I got the answers Not so boring	Really turns me on! Learn a lot with not too much trou Would like all my courses like this Not at all boring

Appendix C

Suggested Revisions Content
Summary

Segment: 9

Date: 1/8/69

	Objective #	Page	Student Reaction
IIB	0834	✓ 35	Students had trouble deciding just what was wanted in these questions
I,B	0831	✓ 40	More than half the students missed [illegible] 18. It seems to be because they did not realize that a shift to the left means a decrease in supply. Perhaps this should be added with explanation.
IIB	0833	✓ 43	Over half the students missed each question. They felt the explanation was too vague. They also would like to have two more problems to help them get the pattern. With a better explanation, more problems might not be necessary.
IIB	0835	✓ 43.	Half the students missed this because they had forgotten about the relation of supply [illegible] price. An additional example is needed to give them another opportunity to solve such problems.

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Appendix C

Suggested Revisions Segment Test
Summary

Segment: 9 Date: 1/8/69

Objective #	Page	Student Reaction
mf4 0827	46	Using figures in the graphs to determine the [illegible] given relationship.
mf5 0831	44	Four students missed this question. Changed wording in stem. Changed items in materials to both verbal and graphic explanation.

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Appendix C

Suggested Revisions Content
Summary

Segment: 23.

Date: 2/3/69

Objective #		Page	Student Reaction
Mgt	1550	p. 20	Explanation inadequate - need to include "[illegible] & that necessary for this is geography in which they have learned [illegible] the [illegible] [illegible].
Mgt.	1524	p. 17	Problem # 9 - with difficult. - No math in the problem. No change 2/4/69

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Appendix C

Suggested Revisions Segment Test Summary

Segment: 23

Date: 2/3/69

Objective #	Page	Student Reaction
		No problems No revisions

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appendix U

Original

Obj. # 0833 How do Expectations About Prices Affect Current Supply?

Anticipation of future price changes will often cause changes in current supply, but it is difficult to predict precisely what sort of changes.

Consider how expectation of an increase in price might affect the present supply of tires. (Remember that "supply" refers to what producers place on the market, not necessarily to what they have in their warehouses.) A tire manufacturer might withhold part of his current stock of tires from the market, hoping to sell them later at the higher price and thus reducing the current supply of tires. Or he might decide to increase production and put more tires on the market right away, thus increasing the current supply of tires. (He might take this latter course to be sure that a large supply of his tires were available to the market from the very first moment of a price increase.)

It should be noted that in either event supply will be increased eventually, i.e., at the time the price increase actually occurs. What is not certain is what happens to the current supply when a price change is anticipated.

Now test yourself on two questions.

22. Bob expects the war to cut back the importation of good A. Bob, who produces good A domestically, figures that the price of good A will rise in the future. What will be Bob's reaction in regard to the supply of good A?

    a. Bob will supply less now but more later.
    b. Bob will supply more now but less later.
    c. Cannot predict without further information what Bob will do.
    d. Bob will not change his current supply.

23. Jack, a manufacturer of radios, expects a flood of Japanese radios to decrease radio prices. Jack will probably:

    a. Not change his supply
    b. Supply less at the present time
    c. Supply more at the present time
    d. Cannot predict without further information what Jack will do

If the correct responses are not very clear to you, reread the above explanations and also consult:

McConnell, pp. 66-70
Samuelson, pp. 61-63

Obj. # 0833

How do Expectations About Prices Affect Current Supply?

Revised

Anticipation of future price changes will often cause changes in current supply, but it is difficult to predict precisely what sort of changes.

Consider how expectation of an imminent increase in price might affect the present supply of tires. (Remember that "supply" refers to what producers place on the market, not necessarily to what they have in their warehouses.)

A tire manufacturer would most likely withhold part of his current stock of tires from the market, hoping to sell them later at the higher price. Thus, an expected price increase would tend to reduce the supply of tires, shifting the supply curve upward and to the left.

It is possible, however, that the tire manufacturer might increase his current supply of tires to be sure that a large supply of his tires would be available to the market from the very first moment of a price increase. In this case, his supply curve would shift downward to the right.

Thus, we cannot predict precisely how supply would change in anticipation of future price changes.

It should be noted that in either event supply will be increased eventually in response to an expected price increase, i.e., at the time the price increase actually occurs. What is not certain is what happens to the current supply when a price change is anticipated.

Now test yourself on two questions.

22. Bob expects the war to cut back the importation of good A. Bob, who produces good A domestically, figures that the price of good A will rise in the future. What will be Bob's reaction in regard to the supply of good A?

    a. Bob will supply less now but more later.
    b. Bob will supply more now but less later.
    c. Cannot predict without further information what Bob will do
    d. Bob will not change his current supply.

23. John holds 100 shares of General Motors stock. A favorable merger is announced and he expects the price of the stock to rise sharply. John will probably:

    a. Sell his stock immediately
    b. Sell his stock after the price rise
    c. Retain his stock in anticipation of the price rise
    d. Cannot predict without further information what John will do

If the correct responses are not very clear to you, reread the above explanations and also consult:

McConnell, pp. 66-70
Samuelson, pp. 61-63

APPENDIX G

Excerpt from TR-5.35, "Preliminary Validation Report for Multi-Media Economics Course"

PRELIMINARY VALIDATION REPORT

Introduction

The purpose of this document is to report the results thus far obtained from analysis of the data received from the validation tryouts of both the materials and tests for the Multi-Media Economics Course. Of necessity, since the course ended so recently and all the data have not been available, the results are incomplete and are limited to core materials and selected tests for Concept Areas I and II. Hence, some of the figures reported herein may be substantially altered when additional data only recently received are included.

The amount of learning which has taken place, in terms of objectives learned, the time required by students to accomplish this learning, and the percentage of students achieving this learning are included. Some findings relative to item difficulty and test reliability are also reported. Data used in these analyses represent the performance of a group of students at the USNA as well as that of a group of students engaged for preliminary tryouts in-house.

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Validation of Course Materials

Validation of the course materials rests on the answer to the question, "Have the students learned?" More specifically validation answers these questions:

1. What percentage of the course objectives have been learned by what percentage of the students who have studied the materials?
2. Does this learning represent an increase in knowledge over what was known prior to studying the materials?

The number of objectives learned has been measured by student performance on unit and post tests; whereas, learning gain is the difference in performance on pretests and post tests. Pretests and post tests contain only criterion test items for the terminal objectives of each segment in a concept area. Data for this report were obtained from student performance on the pretest and post test for Concept Area I and the same two tests for Concept Area II.

Concept Area I

Pretest 2 and Post test 16 are made up of criterion test items for 15 terminal objectives of Concept Area I. Since a terminal objective in Concept Area I has an average of 8 enabling objectives supporting it, the 15 terminal objectives represent the learning of a total of approximately 135 objectives.

Analysis of student performance on Post test 16 indicates that more than 90 percent of all students who studied Concept Area I of the Economics course had learned 75 percent, a total

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of approximately 101 of the objectives; about 78 percent of these same students had learned 80 percent or approximately a total of 108 objectives, and 13 percent had learned 90 percent or a total of approximately 121 objectives. Table 1 gives the above information for each group of students, i.e., the Midshipmen and the In-House students.

The above data do not necessarily represent new learning, for one of the purposes of Concept Area One is to call to the student's attention certain basic economic facts with which he may have been familiar from previous experiences, but with which he must be very familiar for this particular course. The mean of Pretest 2 for all students, an alternate form of Post test 16, is 5 terminal objectives; therefore, any student might have known an average of 5 terminal objectives, leaving him 10 new terminal objectives to learn. (There are 15 terminal objectives in Concept Area I.) As indicated by the difference in performance on Pretest 2 and Post test 16, the average gain for all students was 7 out of 10 terminal objectives (70 percent gain) or a total of 62 out of a possible total of 88 objectives. The USNA students showed a slightly higher gain, 80 percent, 70 of a possible 88 objectives, or 8 of 10 terminal objectives.

Concept Area I represents the first three weeks' work in the course. During this period students had to adjust to new materials as well as to a new approach to learning, and the Post test served not only as a test of learning of economics

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TABLE 1

Concept Area I

Terminal Objectives Learned by Student Groups in Percentages

Objectives	USNA Students	In-House Students
90	12.5	13
80	80	75
75	90	98

TABLE 2

Concept Area II

Terminal Objectives Learned by Student Groups in Percentages

Objectives	USNA Students	In-House Students
90	58	29
85	90	60
80	90	100
75	100	100

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but also as a test of how effectively each had adjusted to the use of the new approach.

Concept Area II

Pretest 18 and Post test 48 consist of criterion test items for 37 terminal objectives of Concept Area II. Inasmuch as each terminal objective in this concept area has an average of 6 enabling objectives supporting it, the 37 terminal objectives represent the learning of a total of approximately 259 core objectives.

Analysis of the data from Post test 48 indicates that 100 percent of the students learned 75 percent of the objectives, or approxiamtely 194 of 259 objectives; about 92 percent of all the students learned 80 percent or approximately 207 of 259 objectives; 84 percent of all the students learned 85 percent of all the objectives or about 220 of 259 objectives; 53 percent of all the students learned 90 percent or approximately 233 of 259 objectives. Table 2 gives the above information by groups of students.

How much new learning took place is represented by the difference between student performance on Pretest 18 and on Post test 48. The analysis of Pretest 18 gives a mean of 8, signifying that any student could know an average of 8 of 37 terminal objectives in Concept Area II. This would leave 29 new terminal objectives or approximately 203 objectives to be learned. The mean gain was 25 (about 85 percent) of a possible 29 new terminal objectives or roughly 175 new objectives learned.

Student performance improved in Concept Area II seemingly over that in Concept Area I.

Learning Time

Learning time on a per segment basis varied widely among the students. The range of learning time per segment in Concept Area I among the midshipmen was 18 to 75 minutes, with a median of 50 minutes, while the range for in-house tryouts was 18 to 79 minutes, with a median of 38 minutes per segment in Concept Area I.

For Concept Area II, the median learning time per segment for USNA students was 30 minutes, with a range of 15 to 58 minutes per segment, while the range for the in-house students was 21 to 83 minutes per segment with a median time of 35 minutes. The learning time reported is for the self-instructional package only.

Validation of Tests

Validity refers to the faithfulness with which a test measures what it purports to measure. Validity includes both reliability and practicality.

Inasmuch as all test items in the Economics course are criterion referenced (the item paraphrases or is written in language equivalent to that of the objective), each item has content validity. The items were judged valid by senior economists from both the Naval Academy and Sterling Institute. Moreover, these items were judged as to validity by the economist-writers who prepared the materials. In addition, the in-house preliminary tryouts have shown that the items test the objectives.

The tests are practical in that they are easily administered and scored, and it is possible, based on his performance, to prescribe remedial work designed to help an individual overcome his unique problems.

Some statistical evidence of the reliabiltiy of some of the tests has been obtained. When reviewing these coefficients of reliability, the smallness of the sample size must be considered. However, using Kuder-Richardson Formula 20 reliability coefficients of .63, .79, .91, .66 have been obtained. The analysis of tests in terms of reliability has only just begun.

Some studies of the level of difficulty of the items have also been initiated. Of some 170 items studied, approximately 88 percent have a level of difficulty of .80 or above. For the purposes of this course such a low level of difficulty is desirable, for theoretically every student should be able to pass every item; hence, every item theoretically would have a level of difficulty of 1.00. Similarly, the discrimination index is low, and in many cases there is zero discrimination. Theoretically, this is desirable for all students should be able to pass every item in a course such as this.

As the materials are revised, both test items and tests are also revised. Those items which indicate a high level of difficulty or negative discrimination or other problems will be carefully studied for defects and revised as indicated.

Although analysis of data is not completed, there is some evidence that both the materials and the tests are valid for this course.

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APPENDIX H

Internal Memorandum #87-R,
"Explanation of Materials Revision Process Based on Empirical Results"

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MEMORANDUM

April 23, 1969

TO: Economics Project Staff

FROM: E. W. Fitzpatrick

SUBJECT: Explanation of materials revision process based on empirical results

I. Purpose and Scope

As you know, we are beginning the process of revising materials based on validation data from the Naval Academy. This memorandum is intended to document the procedures that affect the individuals who are actually making the revisions. There is no intention of describing some of the statistical analyses which will be done or of discussing the kinds of reports about the validation results which we will be submitting. This memorandum should be of most use to the revisors, who will use the revision procedures discussed, but will also serve as a general explanation for those team members who will need to coordinate their work with the revisors' activities.

II. Background Notes

A. The Data Problem

One of the problems we have had to contend with during the validation tryouts at the Academy is not knowing if students actually studied all of the material before taking a segment, unit, or post test.1/ Another problem is that we do not know, for sure, how long a student studied a particular learning segment. (Often students forget to record their study time completely or try to recall, long after the studying was done, how much time was devoted to each segment.) The point is that we cannot pretend the validation data are better than they actually are. In making revision decisions based on validation data, therefore, we cannot afford to overlook the in-house preliminary tryout results as one of the factors in making a final decision.

1/ In regard to a segment self-test, for example, the student may first take the test to find out what he does not know, then proceed to study the learning materials. Or he may study the material somewhat, take the test, and then restudy the material because he did poorly on the test the first time. In any event, the punched card we get of his responses is from the first time he took the test.

B. The matter of Flags

"Flags" are used to indicate on segment, unit, and post tests the items which were missed by more than ten percent of the students. (A flag is a red "x" alongside of the test item.) One flag is used to signal that between 11 and 20% of the students missed the item; 2 flags signal when more than 20% missed an item.

We would like to see 90/90 (i.e., 90 percent of the students achieving 90% of the objectives) but there may be perfectly acceptable reasons why, say, a 90/75 arrangement is appropriate for a particular segment.

III. Revision Procedure

The revision procedure may be said to consist of four major steps. These steps are described below.

Step 1. Preparation

After selecting the segment to be reviewed, make sure you have all of the completed forms that you need. There will be a Form E for the post test and, in most cases, a Form E for the unit test. There will be a Form B for the segment self-test. Form E is the summary of student performance on a concept area "post test" or a "unit test" within a concept area. Form B summarizes student performance on a segment self-test. You should also have a copy of the unit and post tests, as well as copies of the student's and instructor's critique-sheet responses.

Step 2. Post/Unit Test Notation

Now proceed to review the one or two form E's for flags relating to your segment. It would be a good idea to note in the segment package those objectives which received 1 flag and those objectives which received 2 flags on either the unit test or the post test. An example of how this can be done is:

U1, P2 $\boxed{\text{Obj. 3214}}$

Step 3. Revision Requirements Analysis

At this point, you should review your flags (the ones you wrote for reference alongside of the objective numbers) in relation to the flags on Form B, the results of the segment self-test.

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A. If items (objectives) are flagged on Form B but there were no flags for the related objective from a Form E, then you should consider the following:

(1) Is the objective subsumed by another objective which was tested on the unit and/or post test? If yes, you should see how well the students did on the higher level objective. If they did well, perhaps no revision should be made to the material for this lower-level objective. The assumption may be made that students who missed the related test item on the segment test reviewed the related learning material before taking the unit or post test.

(2) Perhaps the objective is not subsumed by another and that it simply was not among the objectives picked for inclusion in the unit or post test. There is a limit to how big these tests can be, which restricts the sample of objectives that can be tested. Nevertheless, it is still possible that students who missed the objective on the segment test, reviewed the related material (as they are directed to by the prescription after the segment test) and would have passed that part of the segment test if they had taken it again. Your good judgment will have to be exercised in these cases.

You should also check the critique sheets submitted by the students and instructors to see if there are apparent problems which require revision. But be very cautious about making changes simply because somebody does not like the way the material is written (or spoken, or displayed) because we may find, too late, that students cannot learn from changes we made to satisfy one or two people.

B. If items (objectives) were flagged on a Form E (unit or post test) but not on Form B (segment test), then several possibilities should be examined. The error could be due to insufficient practice, so that retention suffered, or to lack of comparability among test items, or to poor data from the students (i.e., they didn't really spend time in studying).

(1) Check for comparability of test items among the tests first. If it appears that the items are different (i.e., testing different things or at different levels of difficulty), then you should recommend that this be reviewed by Dr. Furey, and the material should be routed to her when appropriate.

(2) If the test items are comparable, then the problem may be one of either poor retention or insufficient study on the part of the students. Examine the explanation, illustrations, examples, and exercises. Then make a judgment as to whether you could eliminate the performance problem by revising (e.g., adding, deleting, substituting or otherwise changing) any or all of these elements. More practice is one of the best means to increase retention. You may judge, however, that the segment is adequate as it now stands and that students should be specifically asked to review this segment prior to the test.

C. If items (objectives) were flagged on both Form E (unit or post test) and Form B, you have a good case for revising the segment, assuming there are no contraindications. We must still contend with the question of whether the students who missed the test items did so because they never bothered to work through the related segment. If you examine the material and suspect that this might have been the case, check our in-house tryout results to see if they argue against the need for change.

Step 4. Final Review

The revisors themselves will be responsible for the final review of any segments they have revised. Similarly, the Test and Measurement Specialist is responsible for final review of revised tests. However, in all cases involving a change in content, one or more economists will serve as subject matter experts, so that approvals can be made with some degree of assurance in the content area.

Review Panel

In the event a drastic revision seems required, the recommendation will have to be submitted to the review panel. This panel will consist of at least three people: one revisor/economist, the measurement specialist, and myself. If the evidence supports the recommendation, the matter will be discussed with the Academy economists and a final disposition made. A drastic revision would be a change of the following type:

1. Other segments affected
2. Complete re-write of a segment
3. Deletion or addition of a segment
4. Changing the location of a segment

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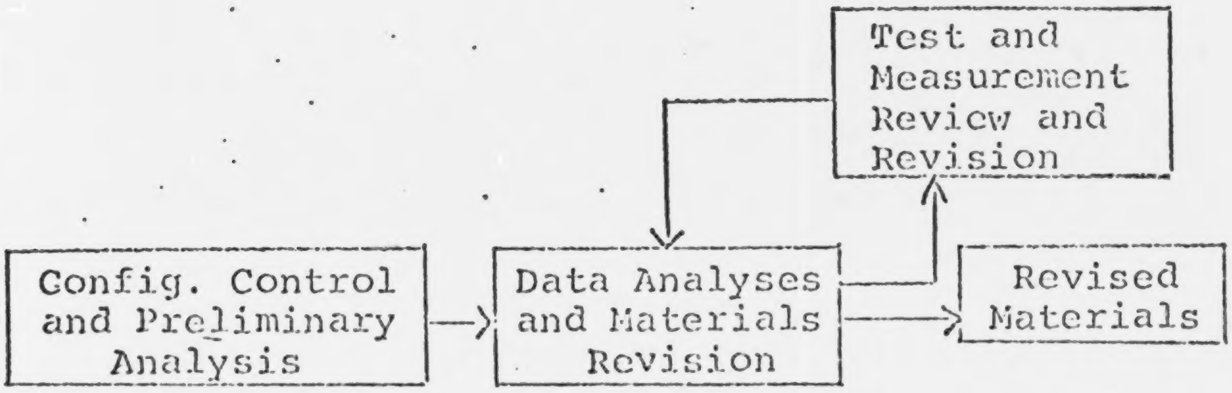
General Workflow

The general workflow may be summarized as follows:


Test and Measurement Review and Revision
Config. Control and Preliminary Analysis
Data Analyses and Materials Revision
Revised Materials

Control Forms Used

Two forms are currently being used for control purposes.

- "Review Action Sheet"- Used at the segment level, this is used to document the actual revisions made to the material, by whomever made the revisions. It is used to record recommended changes and serves as a checklist of the disposition of such recommendations.

- "Segment Routing Log"- Used at the segment level, this log is used to record who received the segment, how long the recipient held the segment, and how much time he applied to it. This data will be used for several purposes, including workload projections.

Increased Economist Support

Dr. Tom Havrilesky, one of our part-time economists, will be consulting with us this summer on a full-time basis, from the second week in June until the end of the first week in September. He will be providing general support to us as a subject matter expert and materials revisor.

Academy Coordination

We are seeking to get together with the Academy economists at the earliest opportunity to discuss changes in the course for the Fall 1969 semester. Their recommendations will have major implications for our revision load this summer. This meeting should take place as soon as Professor McCusker returns from his overseas assignment.

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APPENDIX I

Excerpt from TR-5.39,
"Final Validation Report"

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APPENDIX J

Excerpt from TR-5.40
"Final Evaluation Report

2. SUMMARY

The Multi-Media Economic Analysis Course in its fully operational mode was presented at the United States Naval Academy during the Fall Semester, 1969-70, to 39 randomly selected third class (sophomore) and second class (junior) Midshipmen who had not previously had any economics courses. In the course, the students proceeded at their own pace and exercised options in the selection of media and enrichment, and thus maintained a significant degree of control over when and how they studied. Whenever students have such freedom of choice, many questions arise concerning how well they learn, whether they can complete the course in the required time, whether they like having the responsibility for their learning, etc. During the evaluation of the course these and similar questions were investigated. Both the questions investigated and the findings are presented below.

1. Did the Midshipmen achieve at the expected level of performance?

Ninety-seven percent of the students achieved 80 percent or more of the core objectives of the course. Furthermore, 100 percent of the Midshipmen, in order to meet their learning contracts, accomplished varying numbers of enrichment objectives in addition to those in core. The Academy awarded a grade of "C" to students who achieved the core objectives.

Ninety percent of the students earned sufficient option points from their enrichment activities to obtain a final grade of "A" or "B".

2. What was the relationship between a student's rank in test performance and his rank in QPR, SATV and SATQ?

The correlations between rank in test performance and rank in QPR, SATV and SATQ were low. Little or no relationship existed between a student's rank in test scores and his rank in these variables. Since one of the objectives of the project was to design an economics course in which any Midshipman, regardless of his previous ranks or classifications, could succeed at a specified level, the fact that there is practically no correlation between a Midshipman's rank in scores on tests in the Multi-Media Economic Analysis Course and his rank in other variables seems to indicate the accomplishment of this goal.

3. Did the students show a gain in learning?

From both the practical and statistical points of view all students showed a significant gain in learning. The amount of new information acquired and the increase in their ability to work with economic principles and concepts, as reflected in the difference between the scores on pretests and post tests, indicated a great increase in learning. In response to questionnaires, the Midshipmen reported that as a result of taking the course, they could perform better in activities such as discussing economic problems with parents, read with greater understanding newspaper stories related to economics, and criticize economic policy with a reasoned, stronger basis for their arguments.

4. Were the Midshipmen able to complete the course in one semester?

Although it is generally recognized that the Multi-Media Economic Analysis Course is the equivalent of a two-semester course, thirty-two percent of the students completed the course six weeks before the end of the semester. All of these students earned a final grade of A or B, which required that they also achieve enrichment objectives. One objective in designing the course was to produce course segments that the median student in the conventional course could complete in about 50 minutes' learning time. The median learning time per segment for the Midshipmen in all concept areas was less than 50 minutes, as were the mean and modal learning times. The mean total learning time used by the Midshipmen for all the core materials in the Multi-Media Economics Course was 51 hours and 29 minutes, only 10 to 15 hours more than the time required for class attendance in the conventional course. The Naval Academy student with the greatest total learning time used 97 hours and 39 minutes for core materials, while the one with the least used 30 hours and 33 minutes.

Of considerable interest is the fact that both were among the group who completed the course in only nine calendar weeks. All others completed the economics course in one semester.

All correlations between a Midshipman's total learning time per test and his score on the corresponding test, as well as between his rank in total learning time per post test and his rank in SATV, SATQ and QPR, were low. Therefore, it may be concluded that little or no relationship existed between total learning time per test and any of these variables.

5. Did the five Midshipmen who made the highest scores on each control test differ significantly from those five who made the lowest scores in respect to mean total learning time? What was the correlation between rank in test scores and rank in learning time for each group? Was there any significant difference between the groups in respect to mean QPR and mean scores on SATV and SATQ?

The individuals included in the group making the five highest scores or in the group making the five lowest scores varied for every test. The mean total learning time of the five Midshipmen making the lowest scores was greater than that of the five making the highest scores in six of the nine tests; in the other three, the students with the highest scores had the greatest mean total learning time. Although the mean differences between the groups were statistically significant in only two tests, almost all were significant from a practical point of view because they usually amounted to an hour or more. A student and instructor, knowing of this difference, might be able to plan more efficient learning contracts.

The correlations between rank in test scores and rank in total learning time for the five Midshipmen with the highest test scores were either zero or less than .30 in all but two tests. On those two, the correlations were -.82 and -.71, indicating a high degree of inverse relationship between the variables. In other words, on these tests students who scored highest generally took the greatest amount of learning time. Correlations between the same variables for the groups making the lowest scores tended to be low and in three cases, the correlations were negative. These findings indicated little relationship between rank in test scores and rank in learning time among the low-scoring groups.

In general, the Midshipmen who were among the five making the highest scores on each test also scored higher on SATV and SATQ and had higher QPR's than the five making the lowest scores. The difference in the mean QPR's of the groups was in all but one case statistically significant in favor of those with the high scores. However, in only three or four tests were the mean differences in SATV and SATQ scores statistically significant in favor of the groups of high scorers. Since the differences amounted to approximately 50 points, they had practical significance also.

6. Did the five Midshipmen who used the greatest total learning time differ significantly from the five who used the least total learning time in respect to test scores? What was the correlation between rank in learning time and rank in test scores for each group? Was there any significant difference between the groups in respect to mean QPR and mean SATV and SATQ scores?

The five Midshipmen using the least total learning time usually had a mean test score slightly higher (always less than 2 points) than those using the greatest total learning time. In no test was this difference either statistically or practically significant. These findings are typical of courses requiring the mastery of a high percentage of core material.

Correlations between rank in total learning time per test and rank in test scores for the group using the least total learning time were, with one exception, low and were inclined to be negative. The correlation between these variables on test 16 was -.84, indicating a high degree of inverse relationship. Students who took the least total learning time for this test tended to have the lowest scores. Correlations between rank in total learning time per test and rank in test scores for the group using the greatest total learning time also were generally negative and low. However, on three tests the correlations were +.89, +.87, and +.84, showing a high, direct relationship between the two rankings. Students who used the greatest total learning time for these tests tended to have the lowest scores. In the case of test 11 the correlation of -.80 indicates that students who required the greatest total learning time for this test tended to make the highest scores on it.

The personnel of the group of five Midshipmen using the least learning time and of the group using the greatest learning time varied from test to test. Although the mean QPR and the mean SATV and SATQ scores of the groups with the least learning time were higher than those of the other groups, the difference in the means for all three variables were generally neither statistically nor practically significant. However, the mean differences in SATQ of about 50 points favoring the group requiring the least total learning time for tests 72, 80 and 95 had both practical and statistical significance.

7. Did the group of Midshipmen who completed the course six weeks before the end of the semester differ significantly from the class as a whole in total learning time, test scores, QPR, SATV or SATQ scores?

The group of Midshipmen who completed the Multi-Media Economics Course in nine weeks were not different from the class as a whole in total learning time, test scores, QPR, SATV or SATQ scores. They probably were different in motivation. Both the Midshipman who used the greatest total learning time for core content and the one who used the least were in the group. Moreover, three others who were in the groups taking the least total learning time per test and four who had been in the groups taking the greatest total learning time completed the course six weeks early. Eight of this group had been among the five with the highest test scores; four had been among the five with the lowest test scores. All statistical evidence pointed to the fact that these students were like the rest of the class in respect to total learning time, test scores, QPR, SATV scores and SATQ scores.

8. What conclusions can be drawn from these findings concerning the performance of the Midshipmen in the Multi-Media Economic Analysis Course?

The findings of these studies present conclusive evidence that the core materials in this economics course can be achieved in one semester or less by Naval Academy students similar to those in the experimental program at a 90/80 level of performance and that many can complete additional enrichment material at an equally high performance level within this same time period. The self-pacing feature of the course permits students who require a greater total learning time than their classmates to complete the course in one semester or less, also. These results imply that the design of the instructional materials, which incorporated the sequencing of objectives, the conditions suitable for the type of learning inherent in each objective, and the reinforcement of correct responses, is sound. Eliminating any part of the design in revising this course could result in less spectacular student performance. On the basis of the findings concerning the performance of the Midshipmen, the Multi-Media Economics Course must be evaluated as highly successful in promoting efficient learning of economics by students at the Naval Academy.

9. Did Midshipmen who used audio packages learn the objectives for these segments as well as they learned those presented in the printed texts? How did the performance of these Midshipmen compare with that of the rest of the class in respect to test scores and total learning time?

The Midshipmen who elected to use the audio tape-workbook packages in general did not show great variation in their performance on test items referenced to the segments in the audio packages and on test items referenced to segments immediately preceding and immediately following the audio, which were presented in another medium printed text.

Comparison of the mean scores of the group who used the audio and of the rest of the class on items related to those segments prepared in alternate media were not significantly different, statistically or practically. On the whole, the mean total learning time of the audio group was somewhat less (5 - 10 minutes) than that of the rest of the class. For one audio package the mean total learning time of the audio group was 17 minutes less; for a different package it was 20 minutes greater. These differences would be important to a busy Midshipman in deciding whether or not to try an audio package.

10. Did the Midshipmen who viewed the films have significantly better scores on test items related to the films?

Midshipmen who saw the films had a mean score on items referenced to them in test 27 which was one point higher than that of those not viewing the films. This difference was both practically and statistically significant. The difference in mean scores of viewers and non-viewers on items referenced to films in tests 48 and 72 was statistically but not practically significant.

11. How effective were the computer simulations?

The course included eleven computer simulations of economic systems. Some of these simulations are meant to challenge the most advanced student. No conclusions can be drawn concerning the effectiveness of the simulations, since the computer was usually down when a student needed it. With down time rates reportedly running as high as 80 percent for some students, students typically had to replan their schedules several times in order to run one simulation.

12. What was the student reaction to the course as a whole? What was the instructor's reaction?

Student reaction to the course was overwhelmingly favorable. They found it neither too easy, nor too hard and preferred the self-instructional approach to the traditional lecture approach. When asked to tell what they liked best about the course, they responded most frequently that they liked to be able to determine when, where, and how to study and to decide what final grade to work for. In response to a request for suggestions for improvement, they asked that more non-mandatory seminars relating economic principles to current policies and problems be held.

The instructor, too, was highly complimentary of the course because it promoted the learning of economics easily and well. Although he likes the lecture method, he appreciated the opportunity to work on a more individual basis with students which the self-instructional course afforded him. He, too, suggested there should be seminars concerning current problems and policies. (As the course is designed, the instructor determines when seminars are to be held and their topics. This may suggest that "required" seminars should be built into the course.)

13. What was student reaction to the films?

Reaction to the films was mixed. On the one hand, a majority of the students said that the films were an effective supplement to the course, and that they were relevant and interesting; yet, a majority also reported under the category of what was least liked about the films that they were boring and a waste of time. There were other opinions expressed which were just as contradictory. In view of this reaction, the whole question of films should be reviewed.

14. What was student reaction to the audio tape-workbook packages?

Forty percent of the Midshipmen elected to use any audio-package series. Two of them used all three of the series; the others used one or two. About eighty percent of all the students utilizing this medium were favorably impressed because the tapes made learning easier for them and provided a change in pace. Those who disliked the tapes said they could not concentrate on economics while listening and found it difficult to go back over material they did not understand. A majority of those who used this medium suggested that more audio packages should be included in the course.

15. What problems, if any, existed in the general operational environment of the course?

A self-paced, self-instructional course requires that all materials and media be available to any student when he is ready for them. Operating such a course in the normal environment of the traditional school posed a number of problems in logistics. The Naval Academy solved many of these; however, a few such as coping with computer down-time apparently remain unsolved. Since the films were rented, they could be shown only on a group, not individual, basis at a specified time. Consequently, the content of the films was not always congruent with that which the Midshipmen were learning. The facility in which the films were viewed and the hours when they could be seen were not completely satisfactory. The security of the space in which all materials, including control test and student records, were stored could not be ensured. Some breakdown in communication between instructor and students in respect to the scheduling of seminars and appointments was experienced. All these were problems typically connected with inaugurating a different type of course in any school.

3. STUDENT POPULATION AND LIMITATIONS TO DATA

In any detailed discussion of the Multi-Media Economic Analysis Course, the characteristics of the sample population who took the course should be considered at the outset. Thirty-nine Midshipmen at the United States Naval Academy, 13 second classmen (juniors) and 26 third classmen (sophomores), were randomly selected by the Academy to take the course during the Fall semester 1969-70. None of the students reported having previously had a course in economics. Table 1 presents the scores of the whole group on the SAT Verbal and the SAT Quantitative, as well as their Cumulative Quality Point Rank (QPR) as of 9/1/69. These data reveal a fairly wide range in all three measures as would be found in a random sample. The difference of 82 points between the mean score on the SATV and